Dräger medical
A Dräger and Siemens Company

Technical Documentation

Savina
Intensive Care Ventilator

Revision 8.0
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Contents

General

Function Description

Contents

Maintenance Procedures

Schematics and Diagrams

Annex

Contents

General

1 Notes

This Technical Documentation conforms to the IEC 60601-1 standard.

Read each step in every procedure thoroughly before beginning any test. Always use the proper tools and specified test equipment. If you deviate from the instructions and/or recommendations in this Technical Documentation, the equipment may operate improperly or unsafely, or the equipment could be damaged.

Use only original Dräger parts and supplies.

The maintenance procedures described in this Technical Documentation may be performed by qualified service personnel only. These maintenance procedures do not replace inspections and servicing by the manufacturer.

The information in this manual is confidential and may not be disclosed to third parties without the prior written consent of the manufacturer.

Strictly follow the Instructions for Use manual / Operating Instructions! This Technical Documentation does not replace the Instructions for Use manual / Operating Instructions. Any use of the product requires full understanding and strict observation of the product-specific Instructions for Use manual/ Operating Instructions.

Reference is hereby made to the observance of the relevant safety provisions, for example in Germany, the Medical Product Law (MPG), the Medical Device Operator Ordinance (MPBetreibV), the Pressure Container Ordinance (Druckbehälterverordnung), the Technical Rules for Pressurized Gases (Technische Regeln Druckgase), or the Occupational Health and Safety Provisions (Unfallverhütungsvorschriften).

Unless otherwise stated, reference is made to laws, regulations or standards (as amended) applicable in the Federal Republic of Germany.

Follow the laws and regulations applicable in your country.

1.1 Symbols and Definitions

This symbol indicates a warning.

This symbol indicates tips and useful information.

This symbol is used to alert against unsafe practices when handling electrostatic sensitive devices (ESD).

Definitions according to German standard DIN 31051:

Inspection	=	examination of actual condition
Maintenance	=	measures to maintain specified condition
Repair	=	measures to restore specified condition
Servicing	=	inspection, maintenance, and repair

Function Description

1 General

Savina is a long-term ventilator unit designed for patients with a tidal volume of 50 mL and above, and for the following applications:

– Intensive care unit
– Recovery room,
– Secondary transportation from hospital to hospital,
– Patient transfer within the hospital,
– Transfer flights.

1.1 Working principle

Savina generates the compressed air for ventilation with a blower, which means Savina is able to ventilate without any connection of compressed air or oxygen. A controllable valve is switched in parallel with the blower to regulate the pre-set ventilation parameters. The valve opens or closes according to the pre-set ventilation parameters.
To increase the oxygen concentration in the ventilatory gas, an oxygen concentrator, such as Permox SilentCare, can be connected. If compressed oxygen is connected to Savina, the oxygen concentration of the ventilating gas can be precisely metered. The oxygen concentration is then metered internally with sensors, the associated electronics, and a bank of valves.

1.2 Monitoring

Savina has the following monitoring system:

Measured values	Additional information
Measurement of the airway pressure (Paw)	Pressure curve is pT1-filtered. (T1 = 100 ms) The bargraph is additionally smoothed.
Measurement of insp. and exp. flow	---
Measurement of peak flow (Flow-Peak)	---
Measurement of the inspiratory O2 concentration (FiO2)	PT1-filtered T1 = 2 s
Measurement of airway peak pressure (Ppeak)	---
Measurement of plateau pressure (Pplat)	---
Measurement of airway mean pressure (Pmean)	---.
Measurement of the positive end-expiratory pressure (PEEP)	---
Measurement of the expiratory volume (Vte)	Using the phase information from the ventilation control, the measured value is determined over one mandatory breath.
Measurement of the expiratory minute volume (MV)	Determined over 1 minute and filtered.
Measurement of the spontaneous minute volume (MVspon)	Determined over 1 minute and filtered.

Measurement of the total frequency (Ftot)	Determined over 1 minute and filtered.
Measurement of the spontaneous frequency (Fspn)	Determined over 1 minute and filtered.
Measurement of the inspiratory-expiratory ratio (I:E).	Using the phase information from the ventilation control, the inspiratory time Tinsp and the expiratory time Texp of one respiratory cycle are determined. They are used to calculate I:E = Tinsp/Texp. The measured I:E-ratio is available as output value until the next inspiration is completed. A measurement is not carried out when an ASB breath changes into to a mandatory breath. The output values become invalid when the measurement is inactive, when a new value has not been determined for 15 s, or when more than 45 s have elapsed since the start of inspiration.
Measurement of the plateau time (Tplat) Measurement of the inspiratory time (Tinsp)	Using the phase information from the ventilation control, the inspiratory time Tinsp and the plateau tiem Tplat are determined. The measured times are available as output values until the next inspiration is completed. A measurement is not carried out when an ASB breath changes into to a mandatory breath. The output values become invalid when the measurement is inactive or when no new values have been determined for 15 seconds.
Measurement of the airway resistance (R)	---
Measurement of the compliance (C)	---
Measurement of the temperature at the Y-piece (Temp.)	---
Only if optional NIV is enabled	

Leakage volume in percent (MVleak)	The patient flow and the patient flow clamped towards zero are totalized in two flow totalizers and their average is determined over 400 ms. These average values are filtered using a Bessel filter of the fourth order each and are then used as values for the leakage volume MVleak and the inspiratory minute volume MVinsp. This results in the MVleak readout according to: MVleak [%] = 100% * MVleak / MVinsp.
Patient volume (VTpat)	---
Alarm limits / monitoring	
Apnea detection is adjustable (monitoring can be switched off in NIV).	
Detection of dead space-intensive spontaneous breathing (tachypnea monitoring).	
Airway pressure monitoring adjustable.	
Monitoring of minimum and maximum minute volumes is adjustable.	
Monitoring of maximum tidal volume is adjustable (monitoring can be switched off in NIV).	
The minimum and maximum limits for FiO2 are adjustable in (optional) LPO mode.	
A disconnection time, by which the “!!! Airway pressure low” warning is additionally delayed, is only adjustable in NIV.	

2 Principal components

Savina consists of the electronics, the operator control unit and the pneumatic system, containing the following principal components:

Electronics	Control panel	Pneumatics
Power pack	Front Panel PCB	Plug-in unit
Control PCB	Display	Valve block
Motor Commutation PCB	Membrane keypad	Inspiratory block
O2 Valve PCB	Control knob	Pressure measuring unit
O2 Diaphragm PCB		Patient system
Fan		Flow sensors

2.1 Electronics

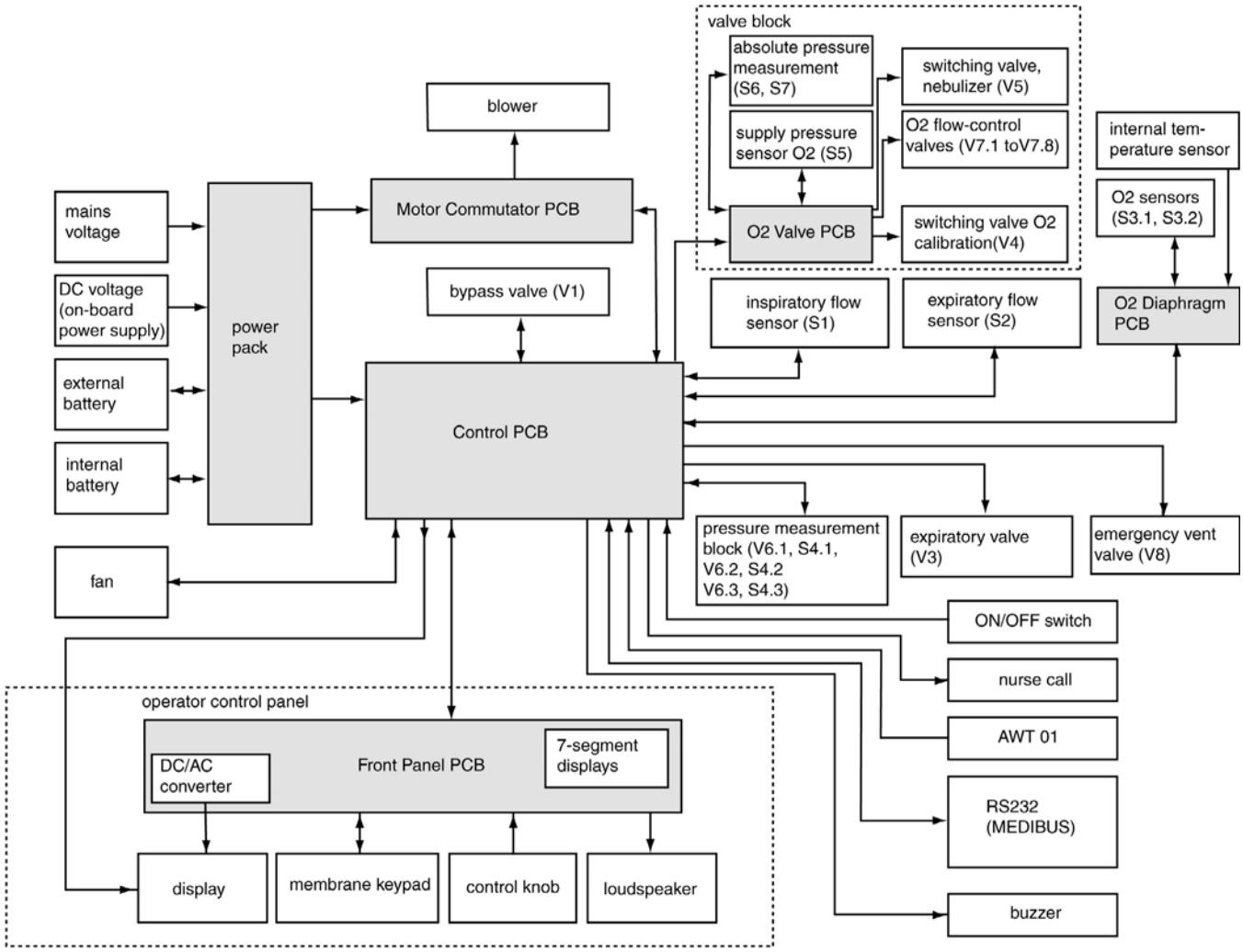

Figure 1 Block diagram of the electronics with operator control

2.1.1 Power pack

The power pack delivers the supply voltages for Savina. The input voltage range of the power pack is 100 V to 240 V AC and 50 Hz to 60 Hz. However, the power pack can also be operated with an external rechargeable battery (12 V or 24 V) or with an external on-board - ambulance/helicopter - power supply (10.5 V to 36 V).

The connection for the alternating voltage is made by a power cable. The connection for the external rechargeable battery or the external on-board power supply is made by a coded plug.

The power pack actuates the three “Mains power”, “External battery or on-board power supply” and “Internal battery” LEDs. The LEDs are mounted on the membrane keypad of the operator control, and indicate the current operating status.

Savina includes 2 internal rechargeable batteries (2 x 12 V) which enable uninterrupted operation in the event of a complete failure of external power. The internal rechargeable batteries supply the O2 sensors with power, even when the Savina is switched off. As a result, valid O2 values are available immediately on power-up.

The power pack supplies the following output voltages:

– +5 V
– -15 V
– +15 V
– +24 V
– +48 V

The output voltages are short-circuit-proof and stable at no-load.

The output voltages are generated according to the following priority, dependent on the input voltages:

Input voltage	Priority	Action
AC voltage	1	Charge external and internal batteries, and maintain the charge.
External on-board power supply	2	Charge internal batteries, and maintain the charge.
External battery/batteries	3	Charge internal batteries, and maintain the charge.
Internal batteries	4	-

The fan cools the power pack. The heated air removes excess oxygen from the control unit and warms the patient system.

2.1.2 Control PCB

The Control PCB is the central “control and monitoring unit” of the Savina. It includes two separate processor systems: the master and front processors. The program memories are Flash-EPROMs. The Flash-EPROMs can be programmed with a laptop connected to the serial port of the Savina (software download).

An EEPROM is provided for each processor system for storage of changeable, non-volatile data. The EEPROM of the master stores the calibration data of the sensors, fan, etc. The EEPROM of the front processor stores safety parameters, settings such as contrast, sound volume, etc., as well as a “backup copy” of the operating hours. The EEPROM of the front processor is plugged in and, if the board needs to be replaced, must be mounted on the new board.

The board is provided with a real-time clock which is used to display the time and to store the software options, the unit identification and the operating hours. The real-time clock is buffered by a battery which is integrated in the real-time clock. The real-time clock also holds the logbook. The real-time clock is plugged in and, if the board needs to be replaced, must be mounted on the new board.

The control PCB contains the following functions:

– Processing of the signals from the sensors (O2, flow, pressure, temperature),
– Control of the blower and valves
– Monitoring of the unit functions and the supply voltages
– Actuation of the displays
– Keypad interpretation
– Delivery of the internal and external interfaces.

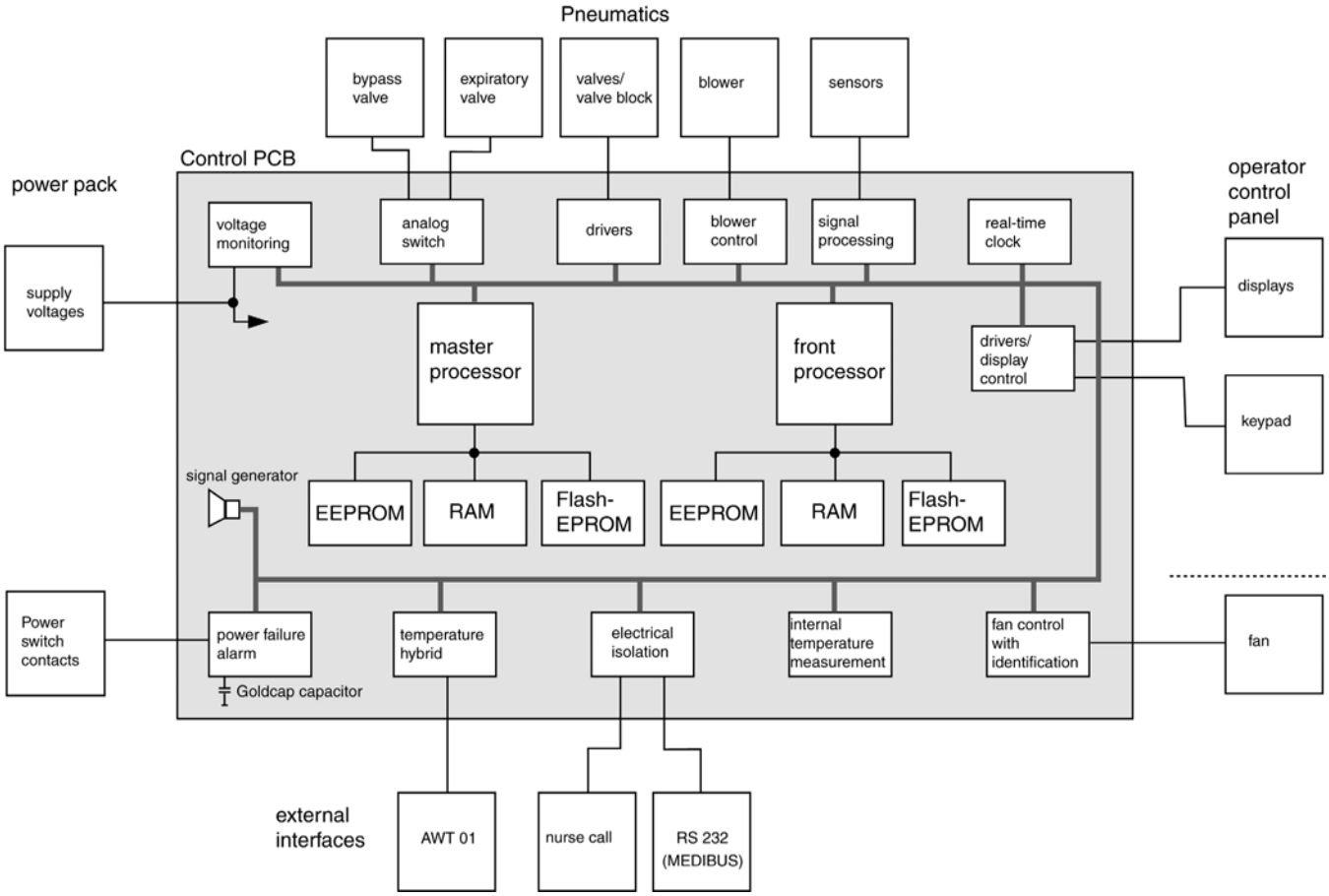

Figure 2 Block diagram: Control PCB

2.1.3 Motor Commutation PCB

The motor commutation PCB controls the motor of the blower. The entire control functionality is located in a self-contained housing. The supply voltage is +48 V, and is delivered by the power pack. The +48V on the Motor Commutation PCB are protected with a fuse (6.3AT).

The input voltage range of the Motor Commutation PCB is 12 to 52.5V. The rotation speed is set by the Control PCB. The control voltage for the rotation speed is 0 to +5.00 V, corresponding to a rotation speed of 0 to 12,000 rpm. The rotation speed range is 4000 to 12.000 rpm.

The Motor Commutation PCB delivers the “actual rotation speed signal” to the Control PCB. The “actual value signal” is 6 pulses per rotation. In the event of discrepancies in the rotation speed the Control PCB adjusts the speed according to the deviation.

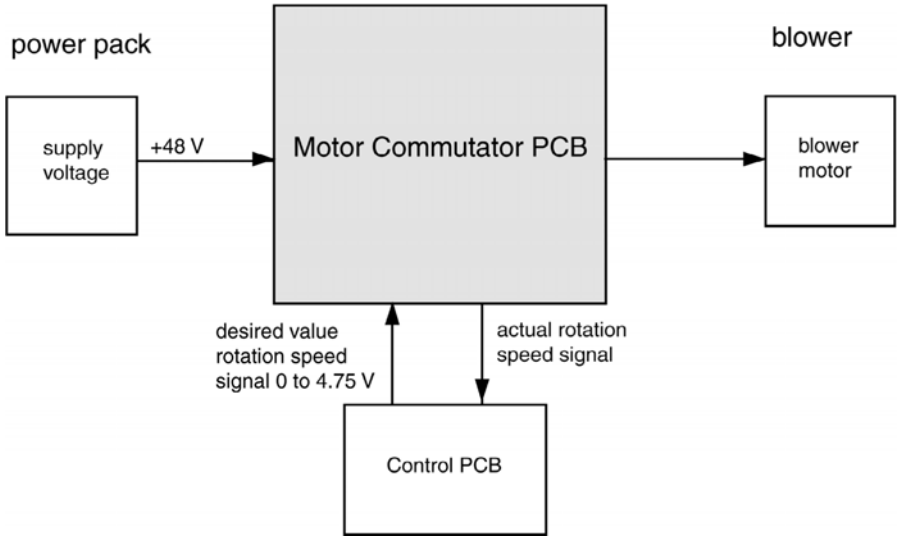

Figure 3 Block diagram of the Motor Commutation PCB

2.1.4 O2 Valve PCB

The O2 Valve PCB holds the pressure sensors (2x absolute pressure S6 and S7, 1x O2 supply pressure S5), the actuator for the O2 calibrating valve and the nebulizer valve, and the actuator for the valve bank.

The signals from the pressure sensors are amplified and passed to the control PCB. The +5 V voltage supply to the pressure sensors is generated on the O2 valve PCB.

The valves in the valve bank, the O2 calibrating valve and the nebuliser valve can be operated individually by an electronic switch. They are actuated by the control PCB.

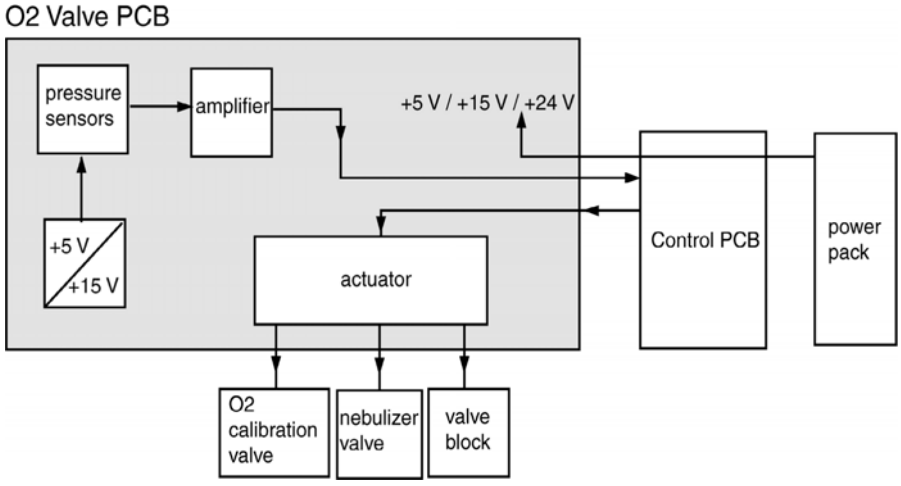

Figure 4 Block diagram: O2 valve PCB

2.1.5 O2 Diaphragm PCB

The O2 Diaphragm PCB amplifies the signals from the O2 sensors and measures the temperature of the O2 sensors and of the respiratory gas in the inspiration block. The temperature of the O2 sensors is required to compensate for the temperature-sensitive O2 measurements. The calibration data from the sensors are stored on the control PCB in an EEPROM. The reference voltage of the O2 sensors is generated from the voltage of the rechargeable batteries, and so is also available when the unit is switched off.

The operating voltages of the O2 diaphragm PCB are +5 V and +15 V.

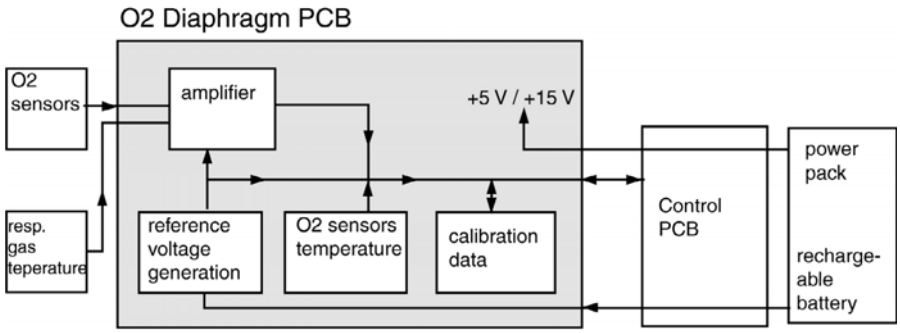

Figure 5 O2 amplifier block diagram

2.1.6 Fan

The fan takes in ambient air through the cooler of the blower and cools the blower. The air flow also removes excessive oxygen from the device.

The voltage supply to the fan is +24V. The rotation speed of the fan is controlled by the Control PCB.

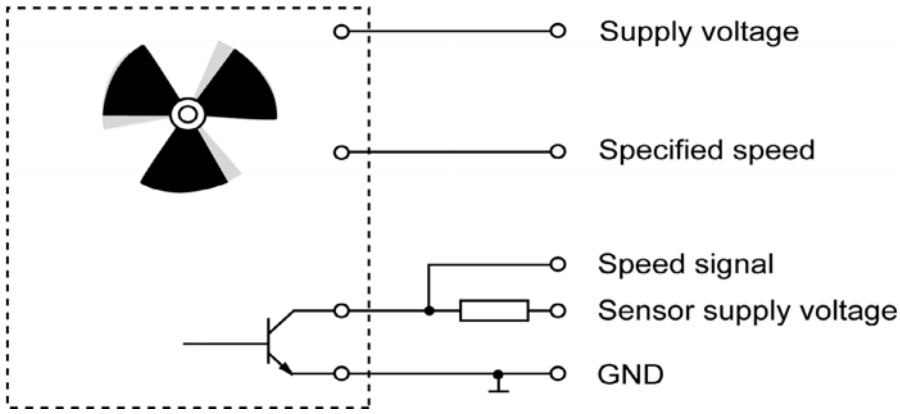

Figure 6 Fan control

2.2 Control panel

The operator control is the interface between the unit and the user. It is used to enter and display the ventilation parameters.

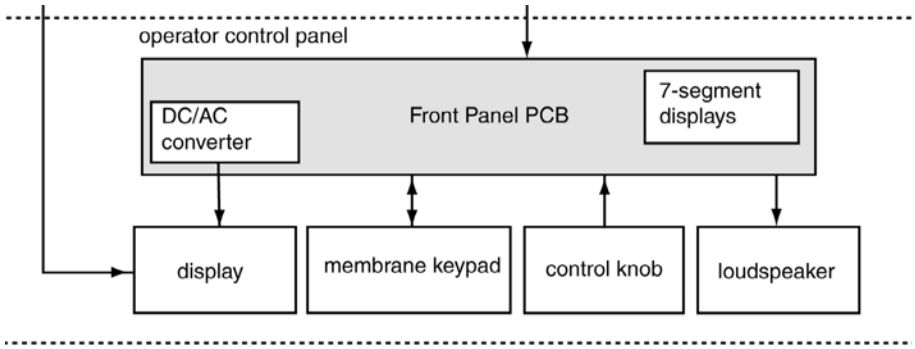

Figure 7 Control panel block diagram

2.2.1 Front Panel PCB

The Front Panel PCB contains the 7-segment displays for the pre-set ventilation parameters, the drivers for the key LEDs, the drivers for interpretation of the keys and the shaft encoder, and the voltage generator for backlighting of the display. The voltage generation for the backlighting can be switched on and off from the control PCB.

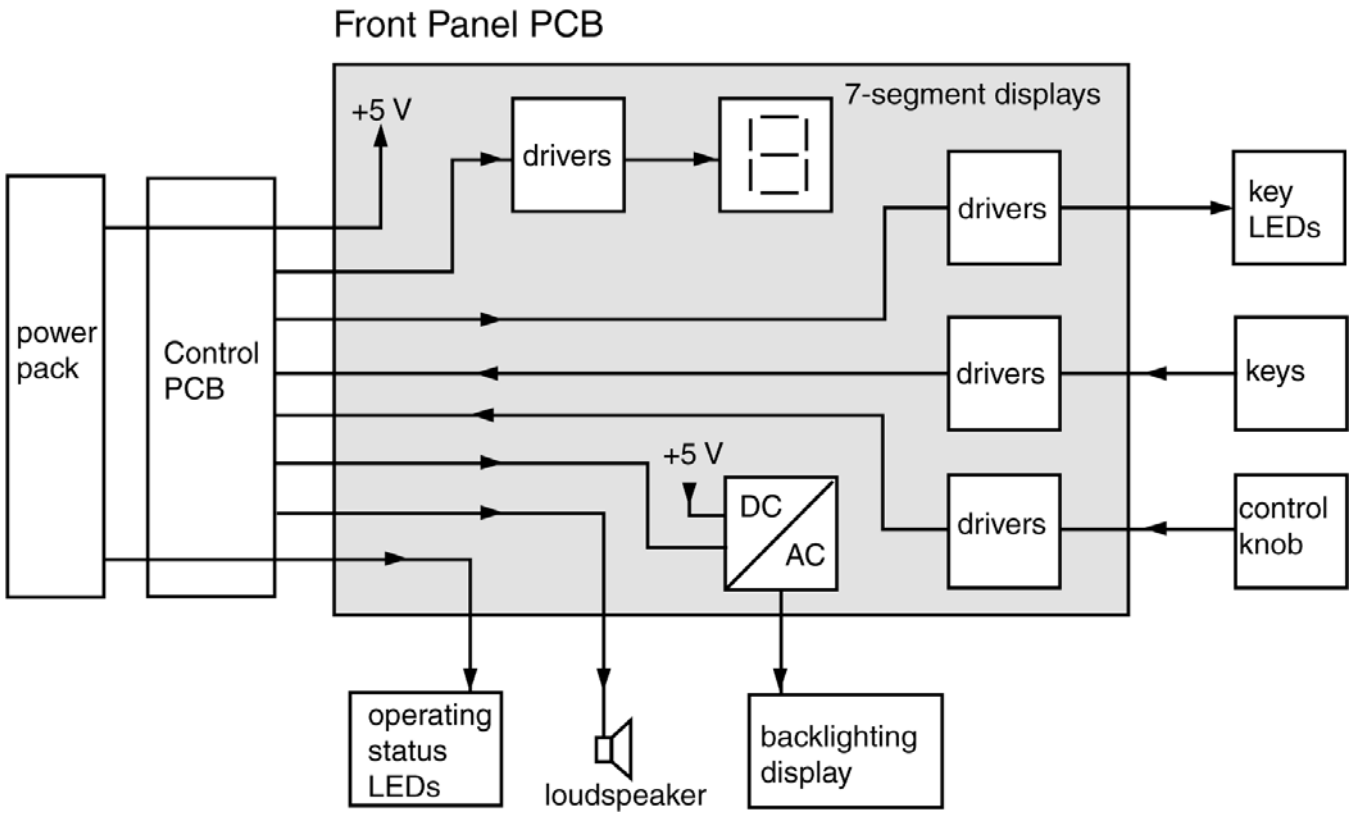

Figure 8 Front Panel PCB block diagram

2.2.2 Display

The display shows the patient parameters and the warning messages. The display is actuated by the Control PCB; the display backlighting is actuated by the Front Panel PCB. The display resolution is 240 x 128 pixels. The voltage supply is +5 V and -15 V.

2.2.3 Membrane keypad

The membrane keypad contains the keys, with associated LEDs, to operate the Savina.

2.2.4 Control knob

The control knob is used to set and confirm changeable ventilation parameters. The control knob transmits square signals to the Front Panel PCB as it rotates, and the signals are then evaluated by the Control PCB. The voltage supply is +5 V.

2.3 Pneumatics

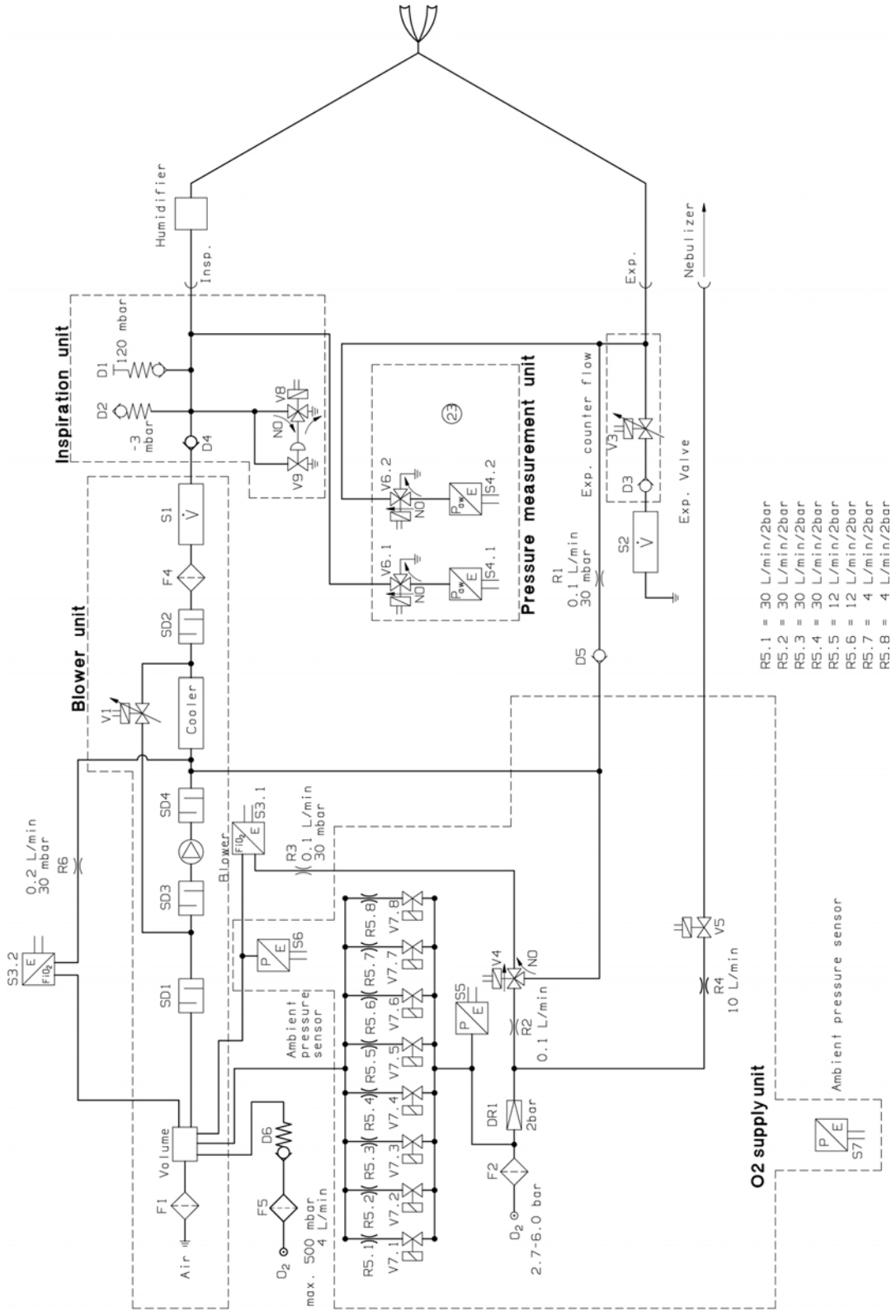

Figure 9 Pneumatic diagram 8412996, revision 23

Pos. no.	Designation
F1	Micro-filter (AIR)
F2	Filter (O2)
F4	Filter for inspiratory flow sensor
F5	Filter (filter element)
SD1	Suction sound muffler
SD2	Sound absorber
DR1	Oxygen pressure regulator
Blower	Blower and motor
Cooler	Cooler
Injector	Injector
V1	Reduction valve
V3	Expiratory valve
V4	Switching valve, oxygen compensation
V5	Switching valve, nebulizer
V6.1	Calibration valve, expiratory airway pressure sensor (located in inspiratory branch).
V6.2	Calibration valve, inspiratory airway pressure sensor (located in expiratory branch).
V6.3	Calibration valve, inspiratory airway pressure sensor (The airway pressure sensor regulates the blower. Only available in the first lot of units).
V7.1 - V7.8	Oxygen flow-control valves
V8	Electric emergency vent valve to operate the pneumatic emergency vent valve
V9	Pneumatic emergency vent valve
S1	Inspiratory flow sensor
S2	Expiratory flow sensor
S3.1	Oxygen sensor 1
S3.2	Oxygen sensor 2
S4.1	Expiratory airway pressure sensor (located in inspiratory branch).
S4.2	Inspiratory airway pressure sensor (located in expiratory branch)
S4.3	
S5	Oxygen supply pressure sensor
S6	Pressure sensor (absolute pressure)
S7	Pressure sensor (absolute pressure)
D1	Safety valve (passive, approx. 120 mbar)
D2	Emergency air valve (-3 mbar to -6 mbar)

Pos. no.	Designation
D3	Expiratory non-return valve
D4	Inspiratory non-return valve
D5	Flush-flow non-return valve
D6	Oxygen connection non-return valve (1)
R1	Flush flow restrictor (0.1 L/min at 30 mbar)
R2	O2 calibration restrictor (0.1 L/min, integrated in valve block)
R3	Restrictor for O2 measurement (0.2 L/min at 30 mbar, sensor 3.1)
R4	Restrictor for nebulizer (10 L/min, integrated in valve block)
R5.1 - R5.8	Restrictors for oxygen flow control
R6	Restrictor for O2 measurement (0.2 L/min at 30 mbar, sensor 3.2)

The pneumatic system comprises the following principal components (see also Figure 9): Pneumatic diagram):

– Plug-in unit
– Valve block
– Inspiratory block
– Pressure measuring unit
– Patient system
– Flow sensors

The following summary describes the functions of the various principal components rather than giving a detailed description of the components themselves.

2.3.1 Ventilation function

The blower draws ambient air through an ambient air filter F1 into a mixing chamber. The blower compresses the gas to a positive pressure of max.140 mbar at a flow rate of up to 180 L/min. The blower is run at constant rotation speed - that is, the speed is not varied in the course of a breath. The inspiratory pressure is regulated by means of the bypass valve. The combination of the blower and the bypass valve function thus represents a pressure source.

On the inlet and outlet sides of the blower there are mufflers SD1 and SD2, which reduce the sound level of the blower.

The bypass valve V1 is operated such that the desired respiratory pressure is applied to the blower outlet, and thus to the patient. In the inspiratory phase when a high flow rate is required by the patient, part or all of the gas flows from the blower outlet to the patient; the gas flow in the return line is reduced. In the expiratory phase the entirety of the blower gas flows via the return line.

A cooler reduces the respiratory gas temperature down to a permissible range. A fan blows cooling air onto the surface of the cooler to dissipate the heat from the cooler.

Expiration occurs via a directly operated valve V3.

The expiratory valve has two functions:

– Controls the PEEP during expiration
– Closes the breathing system during inspiration

2.3.2 O2 mixture with O2 high pressure

In order to be able to ventilate with an increased O2 concentration, the unit must be supplied with 2.7 to 6.0 bar O2. O2 is filtered via the intake filter F2. With the aid of a digital valve bank consisting of 8 digital solenoid valves, O2 is metered into a volume (mixing chamber). The amount of metered O2 depends on the pre-set O2 concentration and on the inspiratory flow rate measured by the flow sensor S1. The addition of O2 is regulated in a closed loop. In the process, the inspiratory O2 concentration is measured by the O2 sensor S 3.1.

2.3.3 O2 mixture with O2 low pressure (optional “LPO”)

Connect only O2 low pressure sources without humidifier to the Savina!

An O2 low pressure source without humidifier feeds the oxygen into the “LPO” connection on the back of the unit. The filter (filter element) F5 protects the non-return valve D6 from coarse particles. The oxygen flows from the non-return valve D6 into the volume (mixing chamber). In the volume (mixing chamber) it is mixed with the fresh air drawn in through the Filter F1.

When no O2 low pressure source is connected to the unit, the non-return valve D6 prevents gas from escaping during normal operation.

In “LPO” mode, the valve bank in the O2 supply is not actuated.

2.3.4 Pneumatic safety devices

The independent pneumatic safety valve D1 ensures that the ventilation pressure can never rise above the legally prescribed limit of 120 mbar. In the event of inspiratory stenosis the pressure is limited by opening the expiratory valve. The mechanical negative-pressure valve D2 ensures (except in the case of inspiratory stenosis) that the patient can breathe spontaneously from the ambient air in case of a fault.

The emergency vent valve V9 relieves the pressure in the breathing system in a case of expiratory stenosis if the pressure cannot be relieved through the expiratory valve. The pilot valve V8 operates the emergency vent valve V9.

2.3.5 Nebulizer function

The medicament nebuliser is operated with 100% O2. The supply pressure regulator DR1 ensures, with widely varying supply pressure (2.7 to 6.0 bar), that the pneumatic medicament nebuliser receives a constant supply pressure of 2.0 bar.

When the nebulizer function is active the solenoid valve V5 operates in an “inspiration” (open position) and “expiration” (closed position) cycle. When the nebulizer function is inactive valve V5 is permanently closed.

2.3.6 O2 calibration function

In normal operation of the unit the solenoid valve V4 is set to “measurement” - that is, the connection between the inspiration and the oxygen sensor is open. During O2 sensor balancing it opens the way for the oxygen to the sensor. This layout permits online calibration of sensor S3.1 during ventilation. Sensor S3.2 must be calibrated manually (patient disconnected).

2.3.7 O2 sensor detection

The unit is provided with an O2 sensor detection. The O2 sensor detection is not required for the optional “LPO”.

2.3.8 Sensors

The absolute pressure sensor S6 delivers the measured atmospheric pressure value required for O2 measurement and for volume application. Absolute pressure sensor S7 monitors sensor S6. Sensor S3.1 delivers the signal for the displayed value FiO2 and the signal for control of the inspiratory O2 concentration. Sensor S3.2 monitors sensor S3.1.

The pressure sensor S4.1 measures the pressure in the inspiratory branch. The sensor signal, in conjunction with the expiratory pressure sensor S4.2, measures, controls and monitors the airway pressure. The airway pressure is measured on the basis of the measured value from the pressure sensor in the respective no-flow branch. Pressure sensor S4.3 continuously measures the airway pressure. The measured value is required to regulate the blower.

Solenoid valves V6.1, V6.2 and V6.3 calibrate the inspiratory pressure sensors and the expiratory pressure sensor. During calibration, the corresponding valve interrupts the connection to the ventilation circuit and switches the sensor to ambient pressure.

Flow sensor S1 measures the inspiratory gas flow. Its measurement variable serves as the basis for calculation of the necessary oxygen flow and thus to operate the oxygen flow control valves V7.1 to V7.8, to control the mandatory breaths and to monitor the functions of the unit. The sensor includes a temperature measurement function to measure the inspiratory gas temperature.

Flow sensor S2 measures the flow via the expiratory valve to the outlet. The flow sensor used is the Spirolog sensor from the Evita series (temperature-compensated hot wire flowmeter with no detection of flow direction). The signal is used for patient monitoring (e.g. minute volume monitoring) among other applications.

Maintenance Procedures

1 General notes

Disinfect and clean the unit or parts of the unit prior to each maintenance procedure.

For “replacement of wear and tear parts” intervals, refer to the Instructions for Use manual. The following replacement procedures are described in this document:

- Replacing the microfilter
- Replacing the dust filter set
- Replacing the O2 sensors
- Replacing the filter in the O2 inlet
- Replacing the lead-gel battery (internal battery)

Read and observe the following warnings before opening the device:

Hazardous voltage. Touching live components can lead to serious injury or death. Disconnect power cord from AC outlet before opening device.

Electrostatic discharge may damage electrostatic sensitive devices. When handling electrostatic sensitive devices, use a static-dissipative mat and a static dissipative wrist strap.

2 Replacing the microfilter

1. Press and hold the two tabs (Figure 1-1).
2. Lift and remove the filter cover (Figure 1-2).

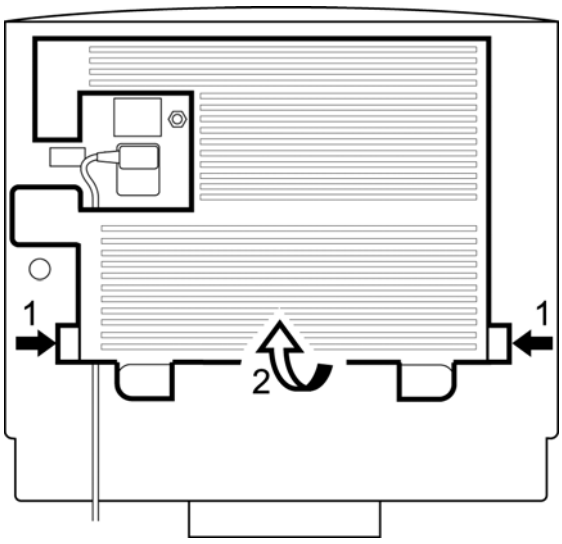

Figure 1 Removing the filter cover

3. Pull the contaminated microfilter out of its mount (Figure 2-1).

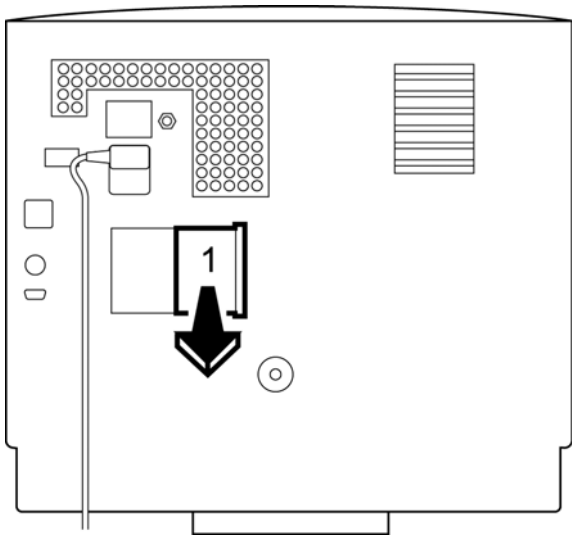

Figure 2 Removing the microfilter

4. Insert the new microfilter into its mount as far as it will go.
5. Dispose of the contaminated microfilter with the normal household waste.

Always use the Savina with a microfilter installed, otherwise the inspiratory side will be contaminated!

6. Insert the two filter cover noses into the rear panel (Figure 3-1).
7. Place the power cable under the filter cover (Figure 3-2).
8. Push the tabs into the mount until they engage (Figure 3-3).

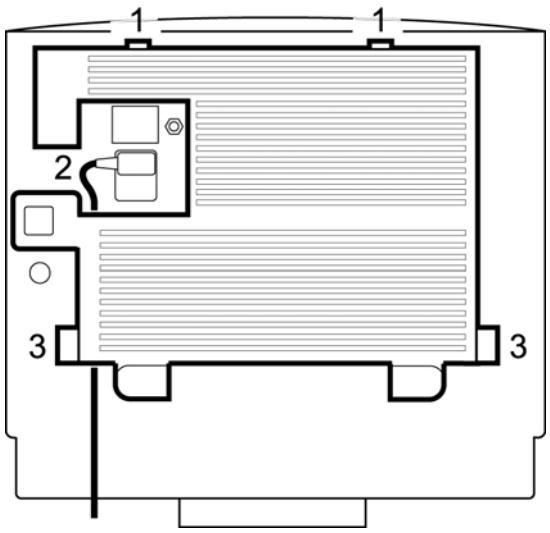

Figure 3 Installing the filter cover

3 Replacing the dust filter set

1. Press and hold the two tabs (Figure 4-1).
2. Lift and remove the filter cover (Figure 4-2).

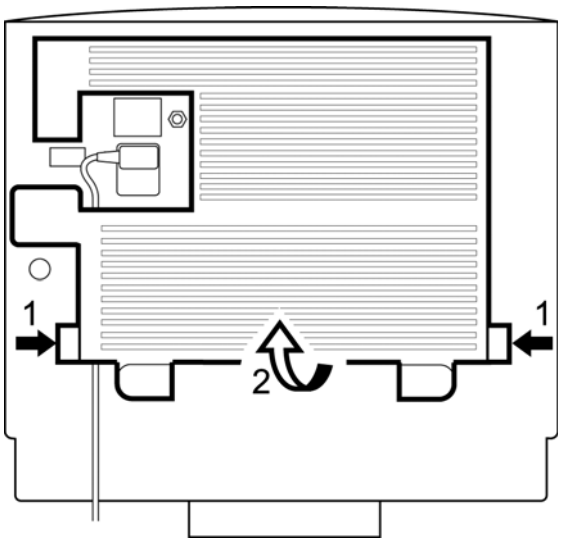

Figure 4 Removing the filter cover

3. Pull the contaminated dust filters out of the filter cover (Figure 5-1).

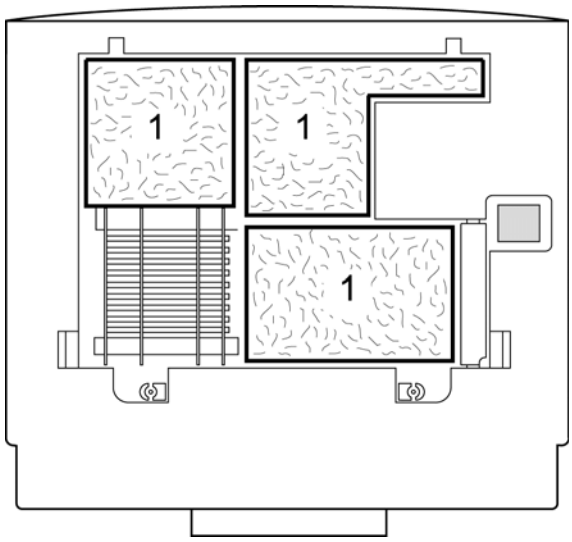

Figure 5 Dust filter

4. Install new dust filters.
5. Dispose of the contaminated dust filters with the normal household waste.
6. Insert the two filter cover noses into the rear panel (Figure 6-1).
7. Place the power cable under the filter cover (Figure 6-2).
8. Push the tabs into the mount until they engage (Figure 6-3).

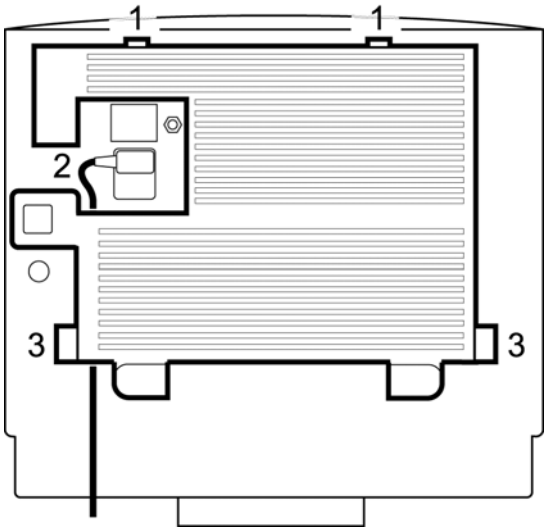

Figure 6 Installing the filter cover

4 Replacing the O2 sensors

1. Swivel the inspiratory port down (Figure 7-1).
2. Unscrew the screw (Figure 7-2), e.g. using a coin, and remove the cover plate.
3. Remove the spent O2 sensor from its mount (Figure 7-3 and Figure 7-4).

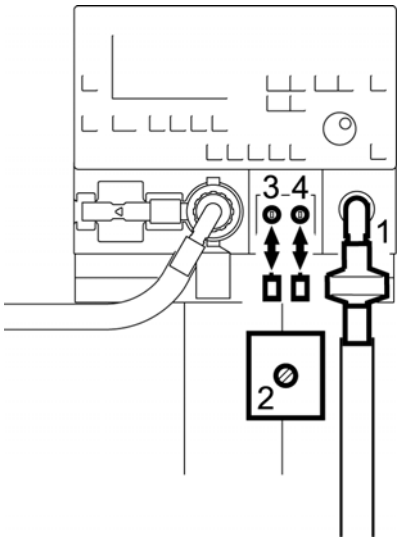

Figure 7 Replacing the O2 sensors

4. Insert the new O2 sensor into its respective mount for “Sensor 1” or “Sensor 2”, and rotate and press lightly on the O2 sensor to slide it further into its mount.
5. Secure the cover plate using the screw.

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Sensor 1
will be calibrated automatically after installation.

Sensor 2
allow a maximum warm-up time of 20 minutes, then calibrate manually.

5 Replacing the filter in the O2 inlet

Hazardous voltage. Touching live components can lead to serious injury or death. Disconnect power cord from AC outlet before opening device.

Electrostatic discharge may damage electrostatic sensitive devices. When handling electrostatic sensitive devices, use a static-dissipative mat and a static dissipative wrist strap.

1. Switch off the unit.
2. Unplug the mains plug from the socket-outlet.
3. Disconnect the O2 gas supply.
4. Press and hold the two tabs (Figure 8-1).
5. Lift and remove the filter cover (Figure 8-2).

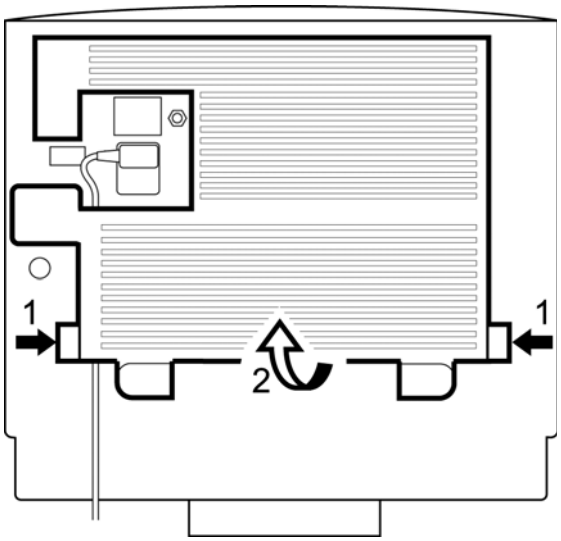

Figure 8 Removing the filter cover

6. Remove the screws from the rear panel (Figure 9).

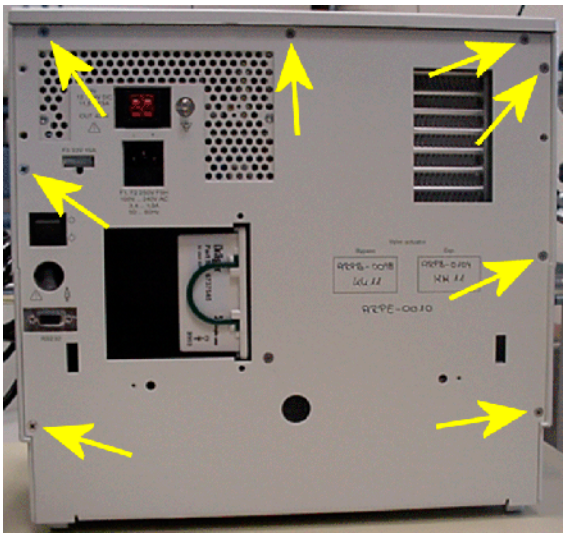

Figure 9 Rear panel fixing screws

7. Remove the rear panel.
8. Remove the microfilter (Figure 10).
9. Remove the plug-in unit (Figure 10).

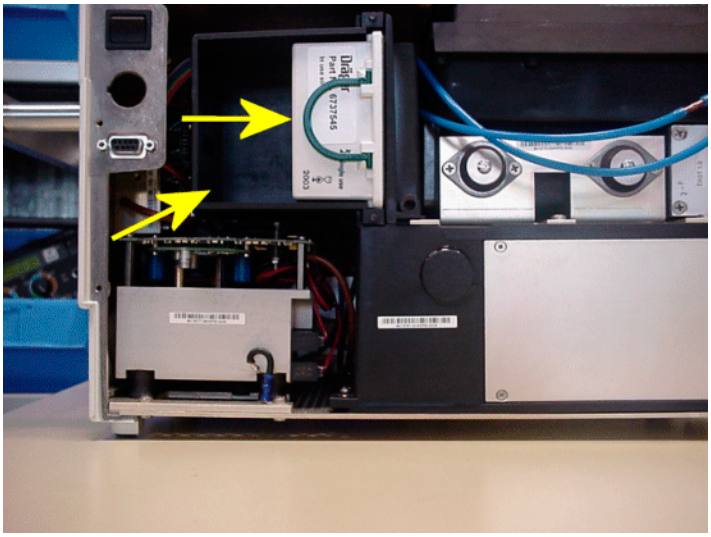

Figure 10 Removing the microfilter

10. Remove the valve block fixing screws (Figure 11).

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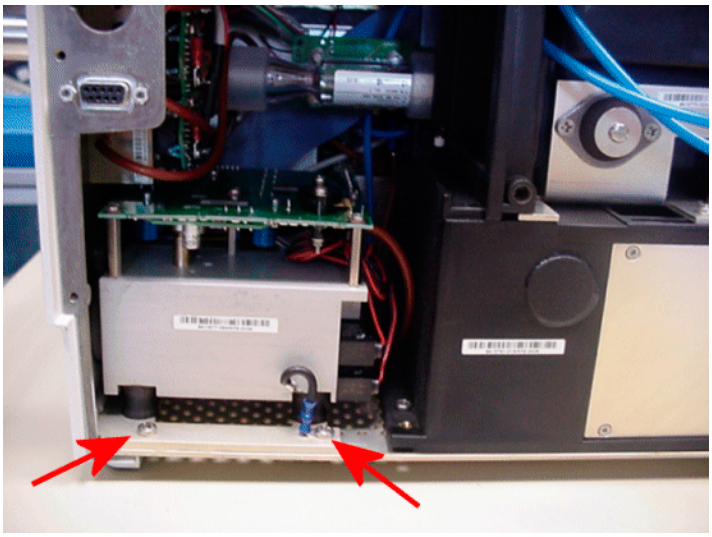

Figure 11 Valve block fixing screws

Remove the sealing ring from the NIST connector. Otherwise the sealing ring could be lost during further disassembly.

11. Remove the NIST connector (Figure 12) (if fitted) and the sealing ring.

Figure 12 NIST connector

12. Remove the inspiratory flow sensor (Figure 13-1) from the plug-in unit (Figure 13-2) and push it upwards.

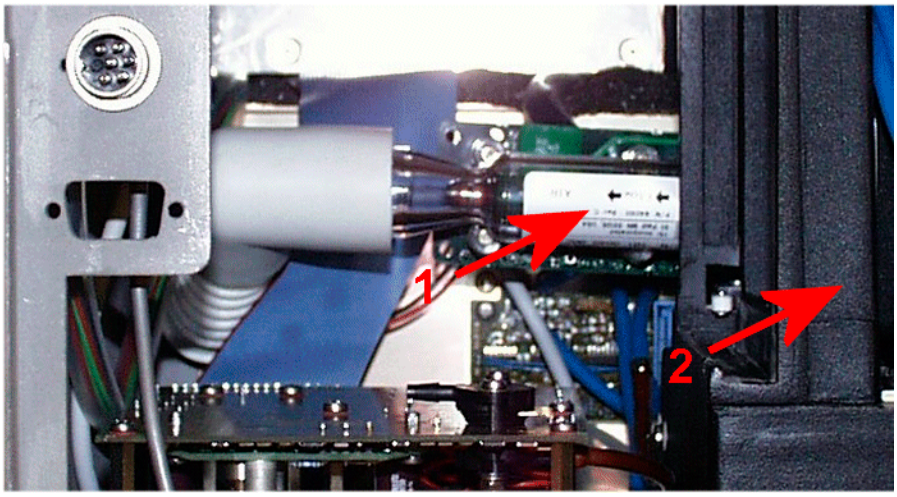

Figure 13 Removing the inspiratory flow sensor

13. Remove large, transparent hose (which connects valve block to plug-in unit) from the plug-in unit.
14. Pull out the valve block a little and turn it 90° counter-clockwise (Figure 14).

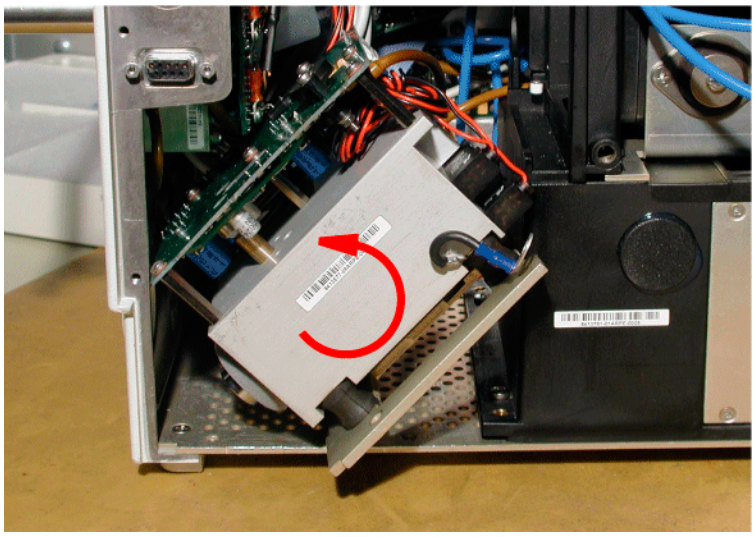

Figure 14 Turning the valve block

15. Mark the hoses leading to the valve block.

Before removing the hoses from the valve block, mark them and make a note of their fitting positions.

16. Remove the hoses.
17. Remove the connector of the O2 Valve PCB.

18. Remove the valve block.
19. Remove the NIST connector mount screws (Figure 15).

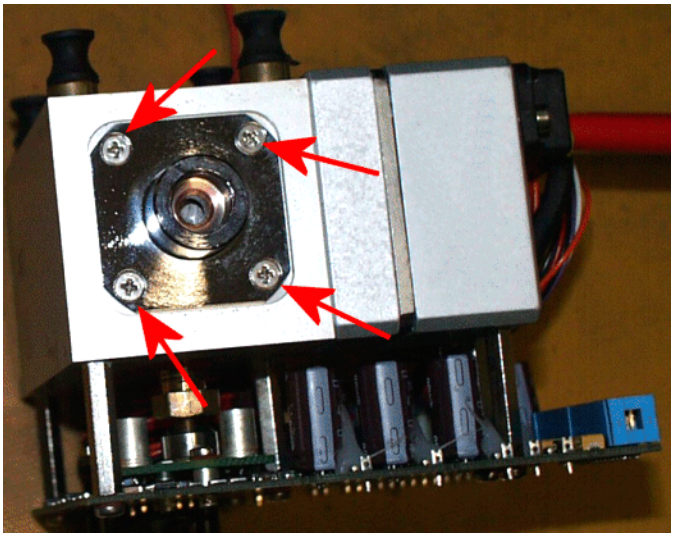

Figure 15 Removing the NIST connector mount

20. Remove the NIST connector mount.

Before removing the filter and the seal, make a note of their fitting positions.

21. Remove the filter and sealing ring.
22. Insert the new filter and sealing ring.

Make sure not to kink any hoses during assembly.

23. Reassemble the unit.

When mounting the rear panel, make sure the hoses point to the left. Otherwise the hoses could buckle (which could lead to error message "O2 measurement").

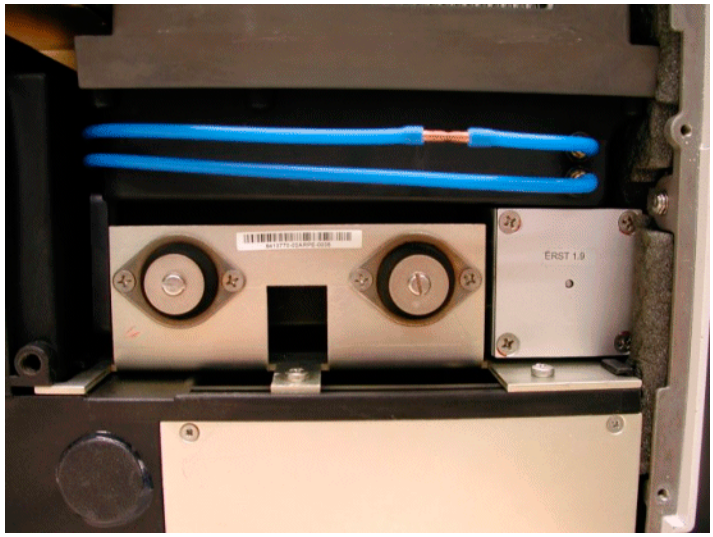

Figure 16 Position of hoses

24. Check the unit according to the Test List and the Instructions for Use manual.

6 Replacing the lead-gel battery (internal battery)

Hazardous voltage. Touching live components can lead to serious injury or death. Disconnect power cord from AC outlet before opening device.

Electrostatic discharge may damage electrostatic sensitive devices. When handling electrostatic sensitive devices, use a static-dissipative mat and a static dissipative wrist strap.

1. Switch off the unit.
2. Unplug the mains plug from the socket-outlet.
3. Disconnect the O2 gas supply.
4. Press and hold the two tabs (Figure 17-1).
5. Lift and remove the filter cover (Figure 17-2).

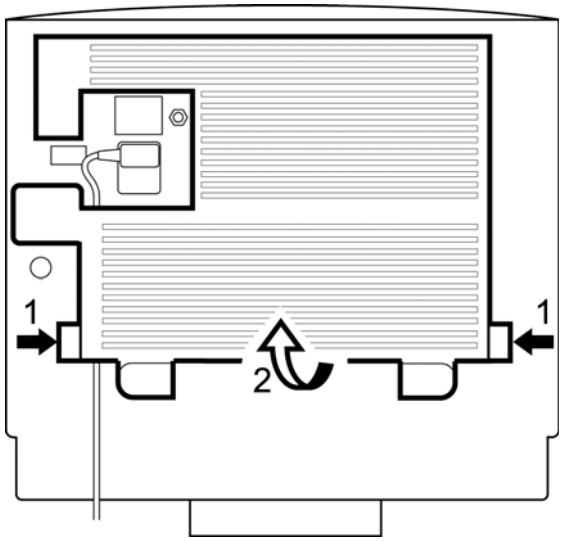

Figure 17 Removing the filter cover

6. Remove the screws from the rear panel (Figure 18).

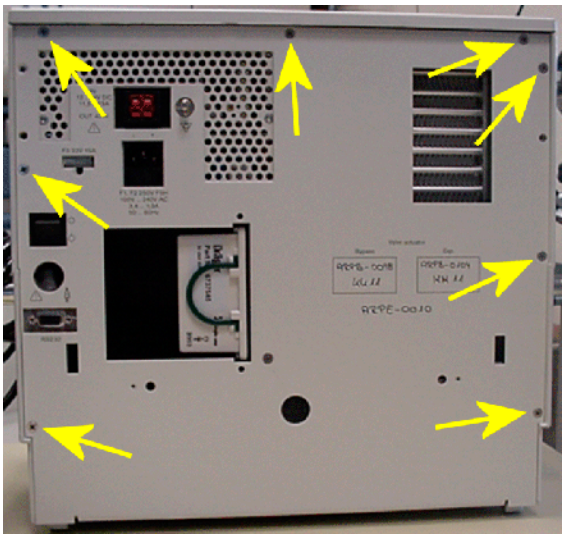

Figure 18 Rear panel fixing screws

7. Remove the rear panel.
8. Remove the fuse for the rechargeable batteries by levering it out carefully with a screwdriver.

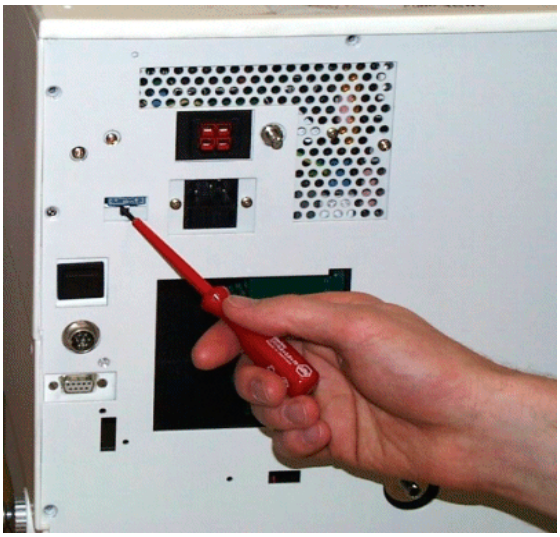

Figure 19 Removing the fuse

9. Remove the cover fixing screws and remove the cover (Figure 20).

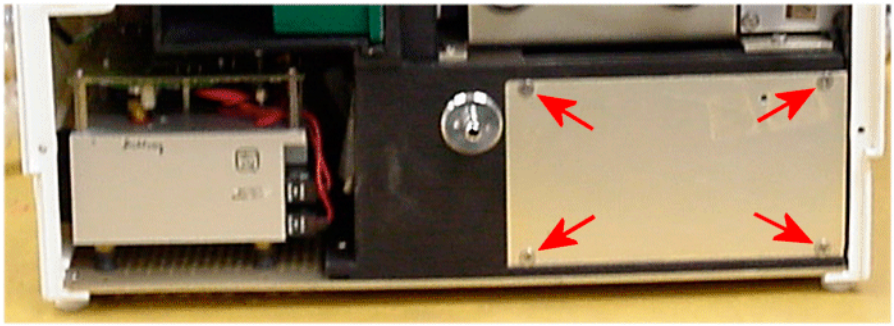

Figure 20 Rechargeable batteries cover

Rechargeable batteries represent special waste. Dispose of rechargeable batteries in conformity with local waste disposal regulations. Reversing the polarity of the rechargeable batteries will damage the batteries and the power pack. Make a note of the connector layout and ensure correct polarity when fitting the rechargeable batteries.

10. Remove the rechargeable batteries.

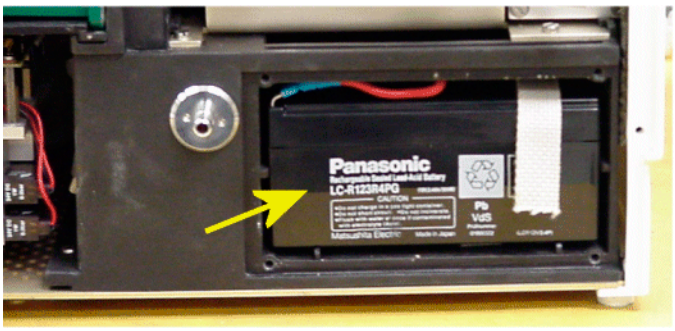

Figure 21 Rechargeable batteries

11. Fit new rechargeable batteries.

When mounting the rear panel, make sure the hoses point to the left. Otherwise the hoses could buckle (which could lead to error message "O2 measurement").

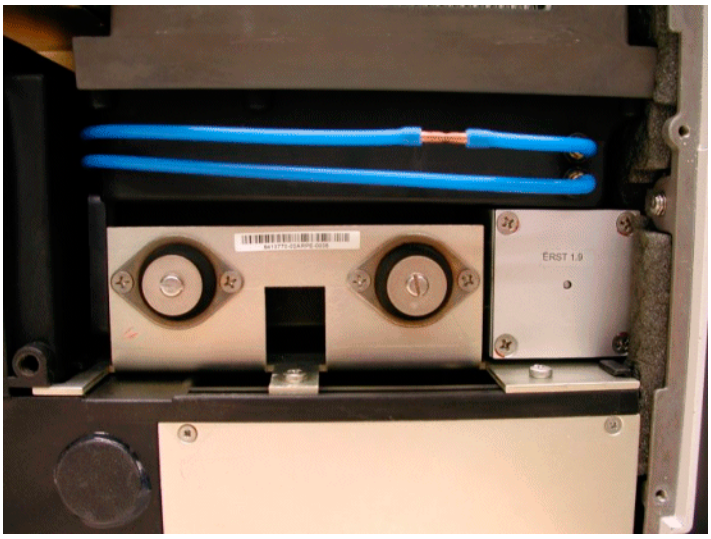

Figure 22 Position of hoses

12. Reassemble the unit.

Inadequate voltage. The new rechargeable batteries are not sufficiently charged. To charge the rechargeable batteries, leave the Savina connected to the AC power supply for at least 10 hours (it is not necessary to switch on the Savina).

13. Check the unit according to the Test List and the Instructions for Use manual.

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Schematics and Diagrams

1 Front view, Savina

Figure 1 Front view, Savina

Table 1 Legend to Figure 1

Position no.	Name
1	Membrane keypad
2	Control knob
3	Inspiratory connection
4	Expiratory valve
5	Expiratory flow sensor

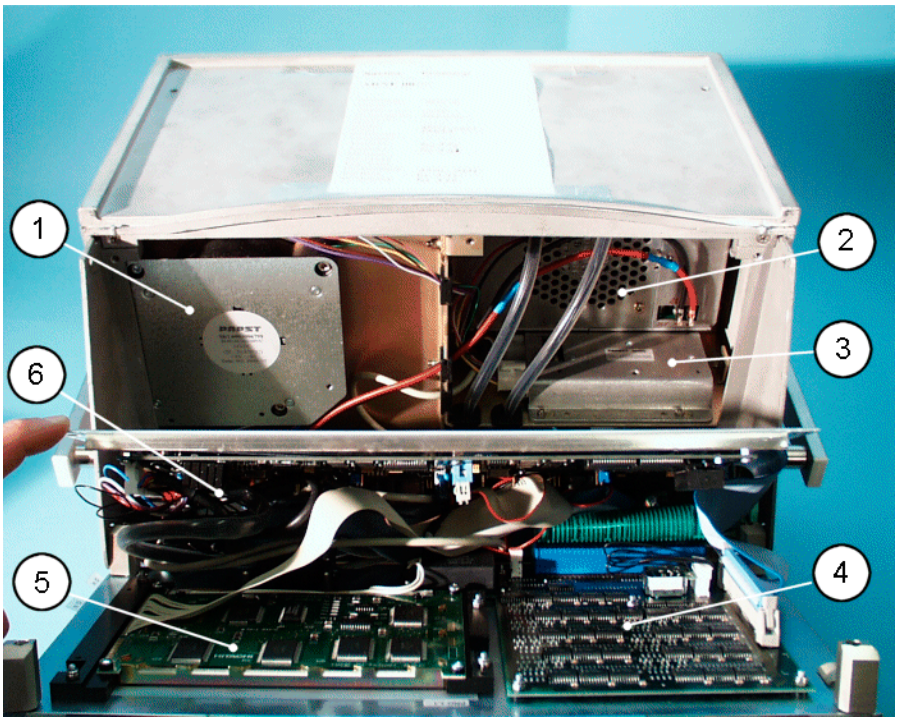


Figure 2 Front view with front panel and Control PCB folded away

Table 2 Legend to Figure 2

Position no.	Name
1	Fan
2	Power supply unit
3	Motor Drive PCB with fuse
4	Front Panel PCB
5	Display
6	Control PCB

2 Rear view, Savina

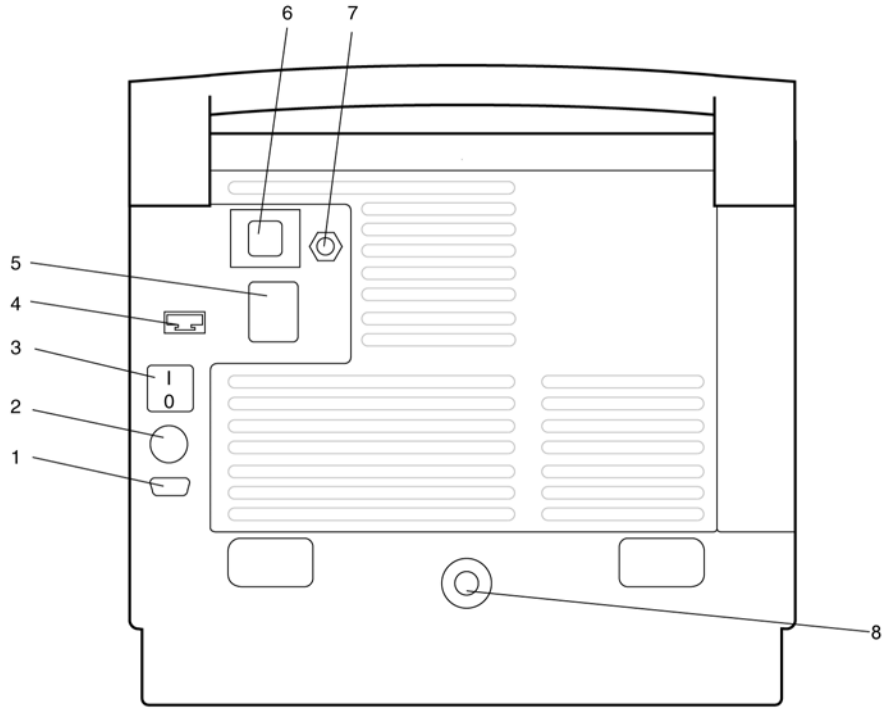


Figure 3 Rear view, Savina

Table 3 Legend to Figure 3

Position no.	Name
1	MEDIBUS interface
2	Nurse call
3	Power switch
4	Fuse of the rechargeable batteries
5	Mains connection
6	Direct voltage socket
7	Earthing stud
8	Oxygen concentrator connector (“LPO” option)

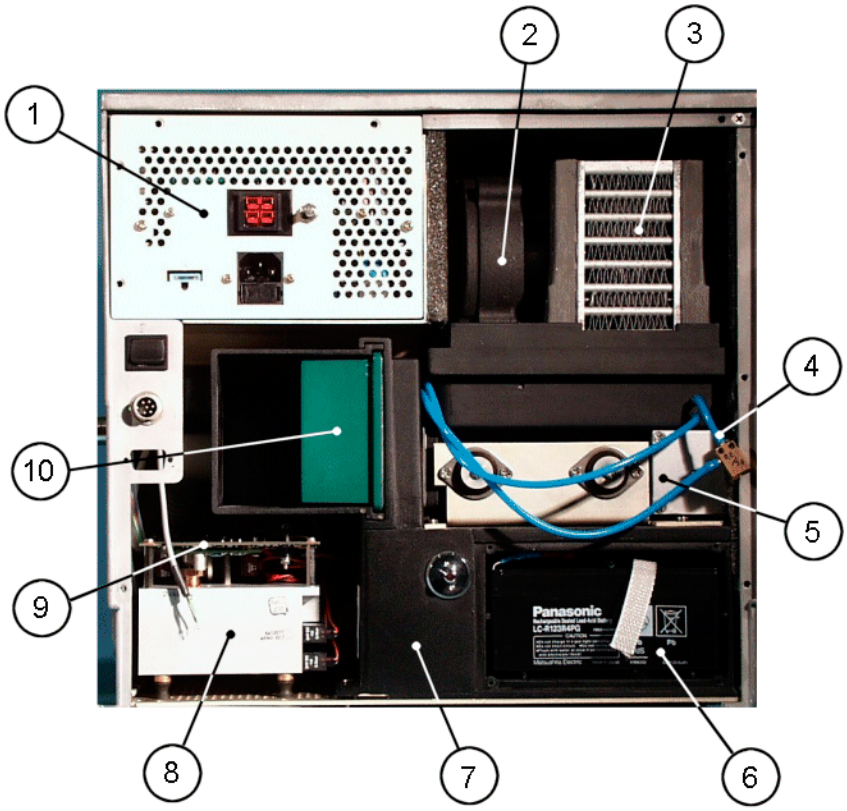


Figure 4 Rear view of the Savina with rear panel removed

Table 4 Legend to Figure 4

Position no.	Name
1	Power supply unit
2	Blower
3	Cooler
4	O2 sensor connector S3.2 with restrictor R6
5	Bypass valve V1
6	Rechargeable batteries
7	Volume
8	Valve block
9	O2 Valve PCB
10	Micro-filter F1

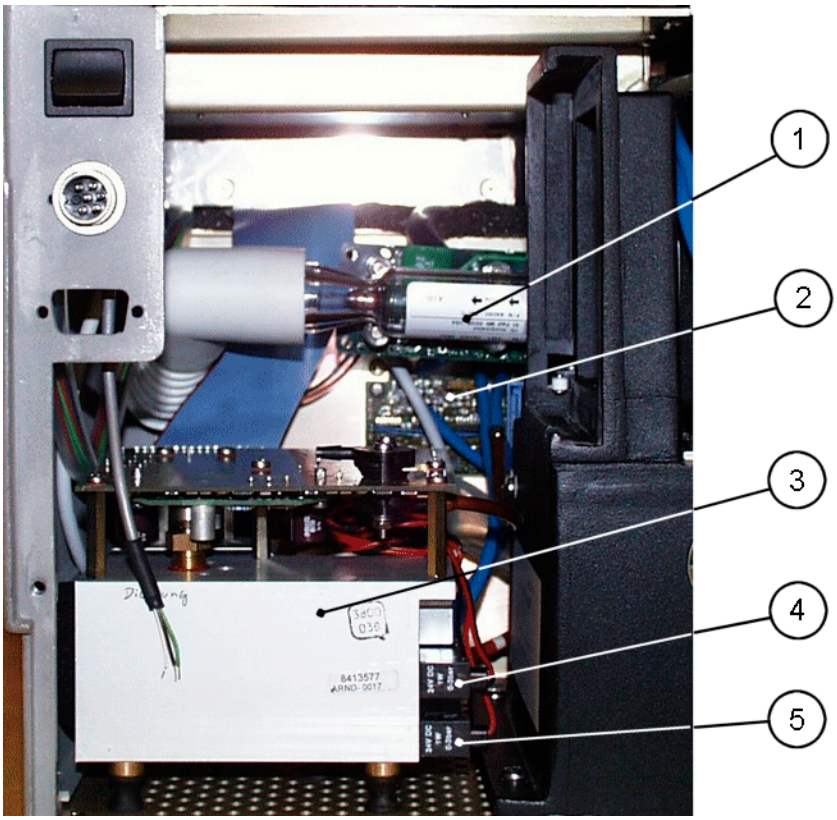


Figure 5 Rear view with micro-filter and its housing removed

Table 5 Legend to Figure 5

Position no.	Name
1	Inspiratory flow sensor S2
2	O2 Diaphragm PCB
3	Valve block
4	Nebulizer solenoid valve V5
5	Solenoid valve V4 to the O2 sensor S3.1

3 Identification of PCBs

3.1 O2 Valve PCB

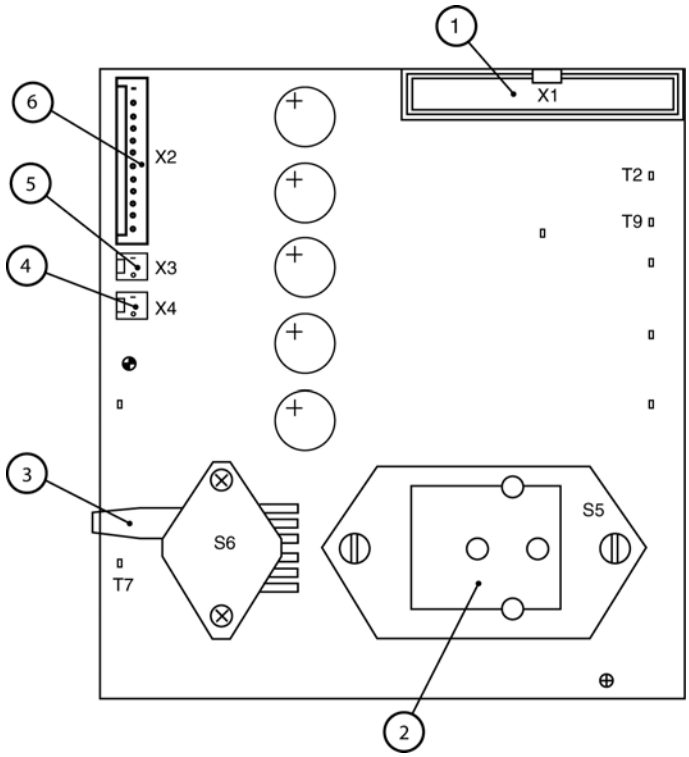


Figure 6 O2 Valve PCB, view 1

Table 6 **Legend to Figure 6**

Position no.	Name
1	To the Control PCB
2	Oxygen pressure sensor
3	Absolute pressure sensor
4	To the nebulizer valve
5	To the O2 calibration valve
6	To the valve block

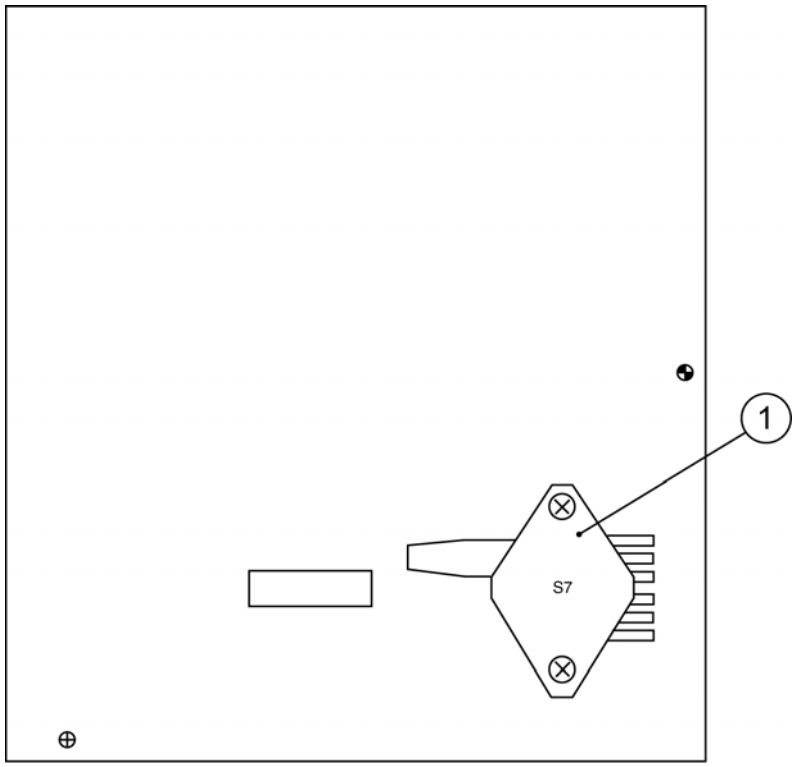


Figure 7 O2 Valve PCB, view 2

Table 7 Legend to Figure 7

Position no.	Name
1	Absolute pressure sensor

3.2 Control PCB

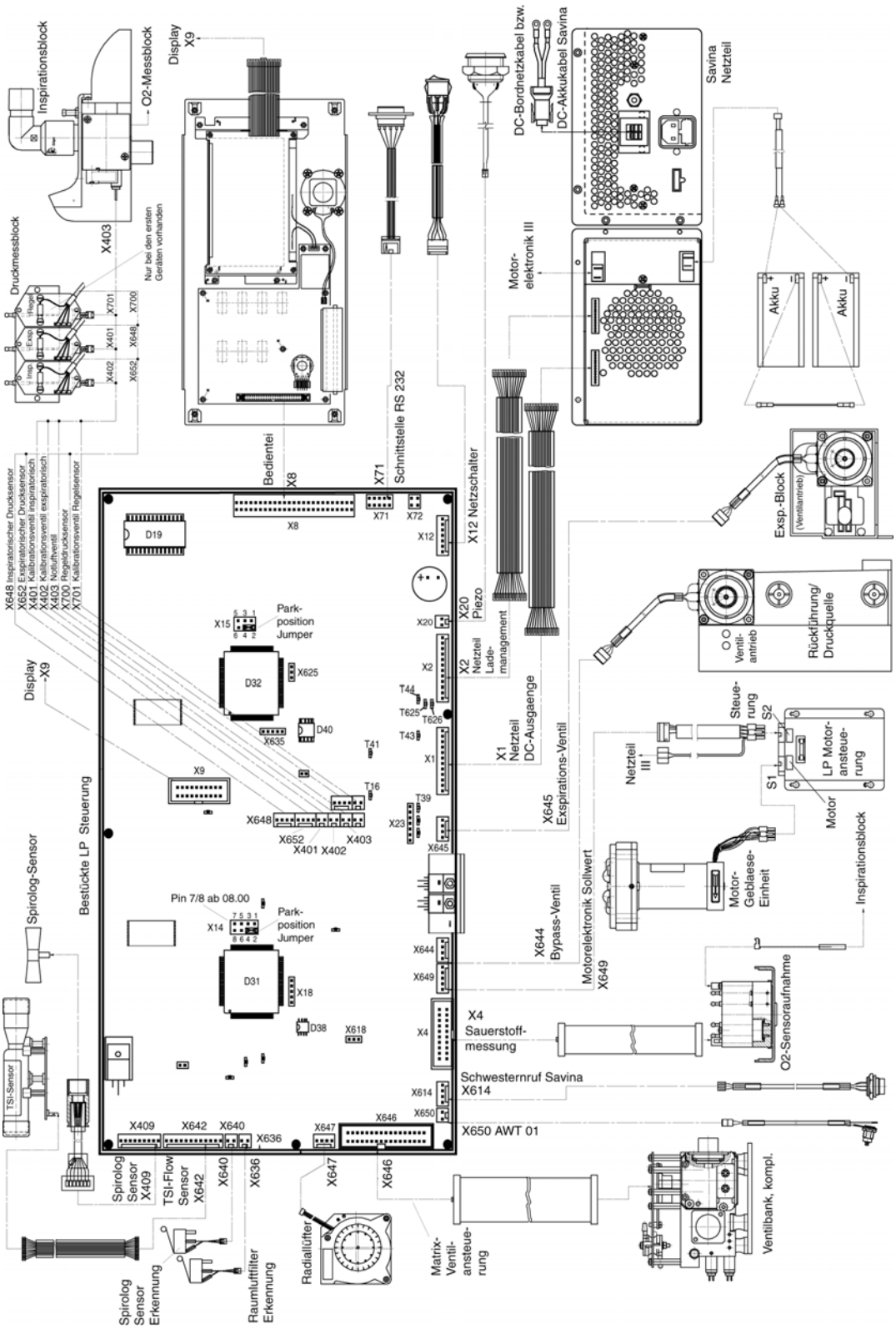


Figure 8 View, Control PCB

3.3 Front Panel PCB

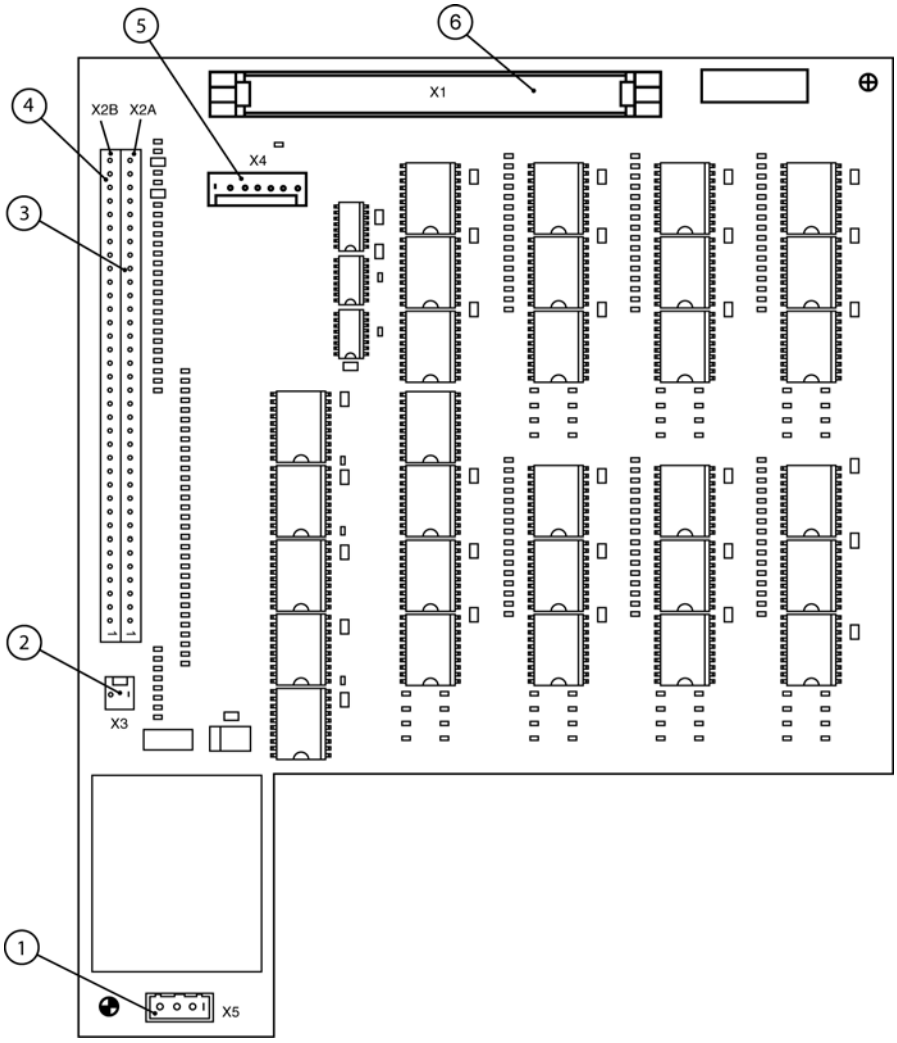


Figure 9 Front Panel PCB, view 1

Table 8 Legend to Figure 9

Position no.	Name
1	Display backlighting
2	To the loudspeaker
3	To the keys
4	To the LEDs
5	To the control knob
6	To the Control PCB

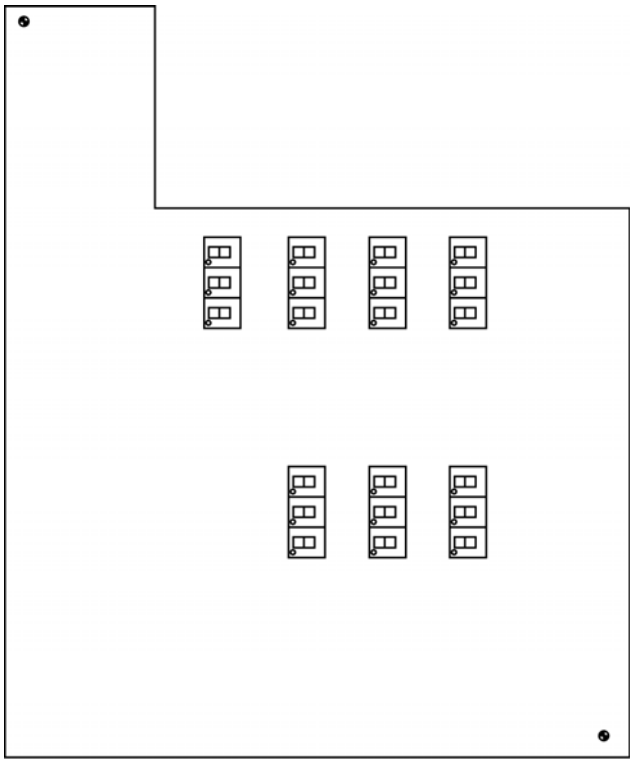


Figure 10 Front Panel PCB, view 2

3.4 O2 Diaphragm PCB

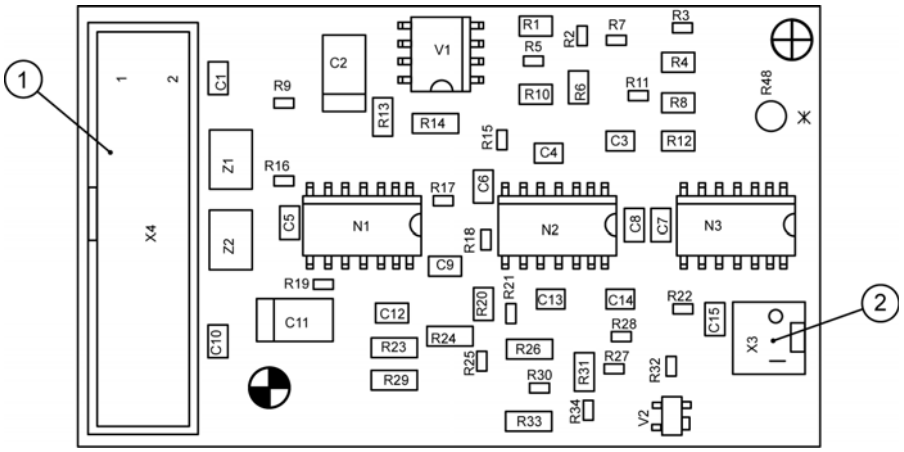


Figure 11 O2 Diaphragm PCB, view 1

Table 9 Legend to Figure 11

Position no.	Name
1	To the Control PCB
2	To the NTC in the inspiration block

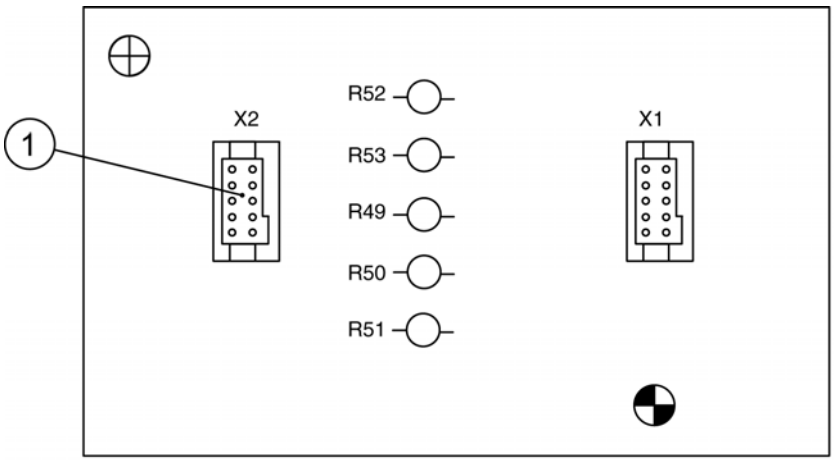


Figure 12 O2 Diaphragm PCB, view 2

Table 10

Position no.	Name
1	To O2 Sensor 2

4 Pneumatic diagrams

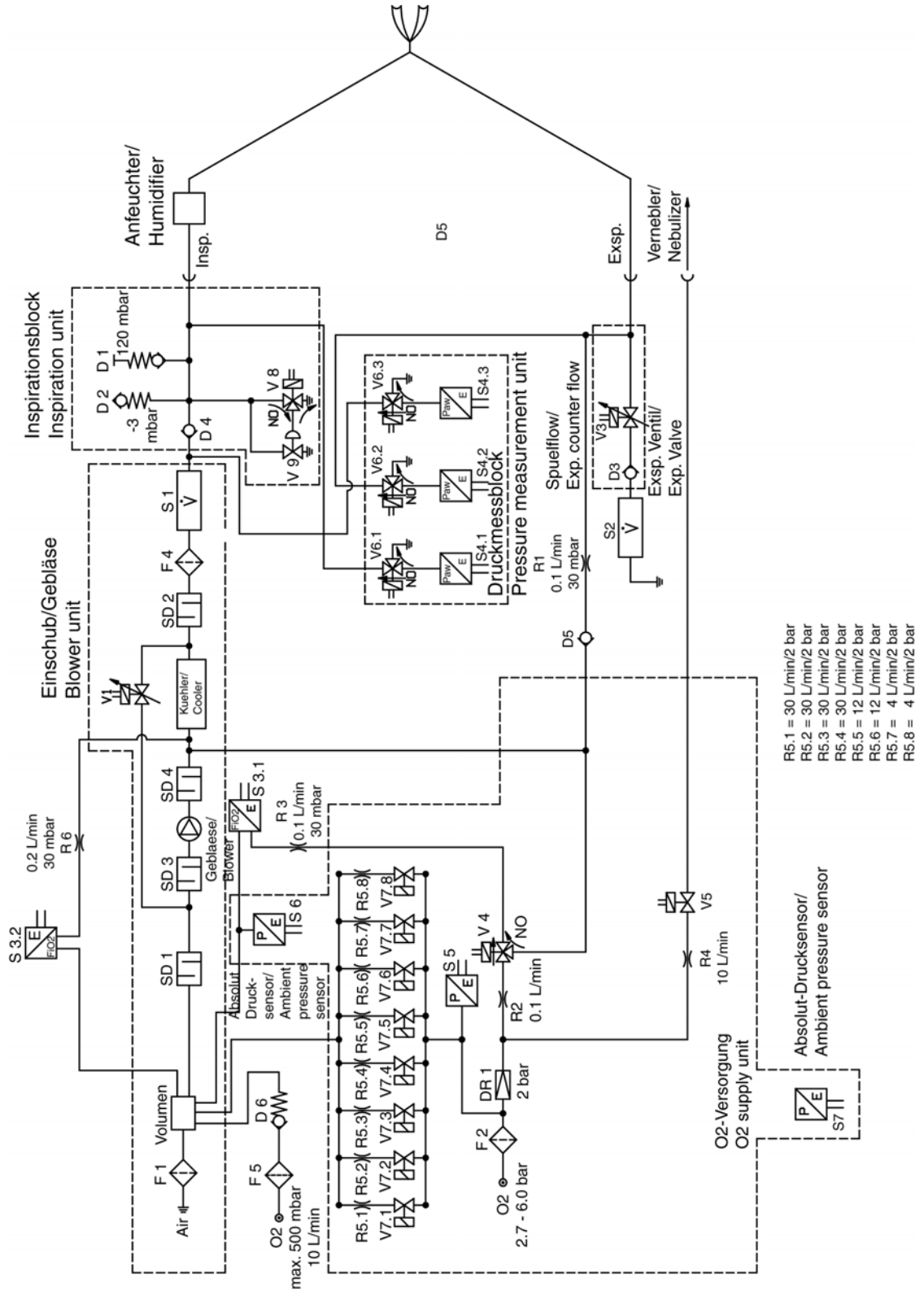


Figure 13 Pneumatic diagram, revision index 07

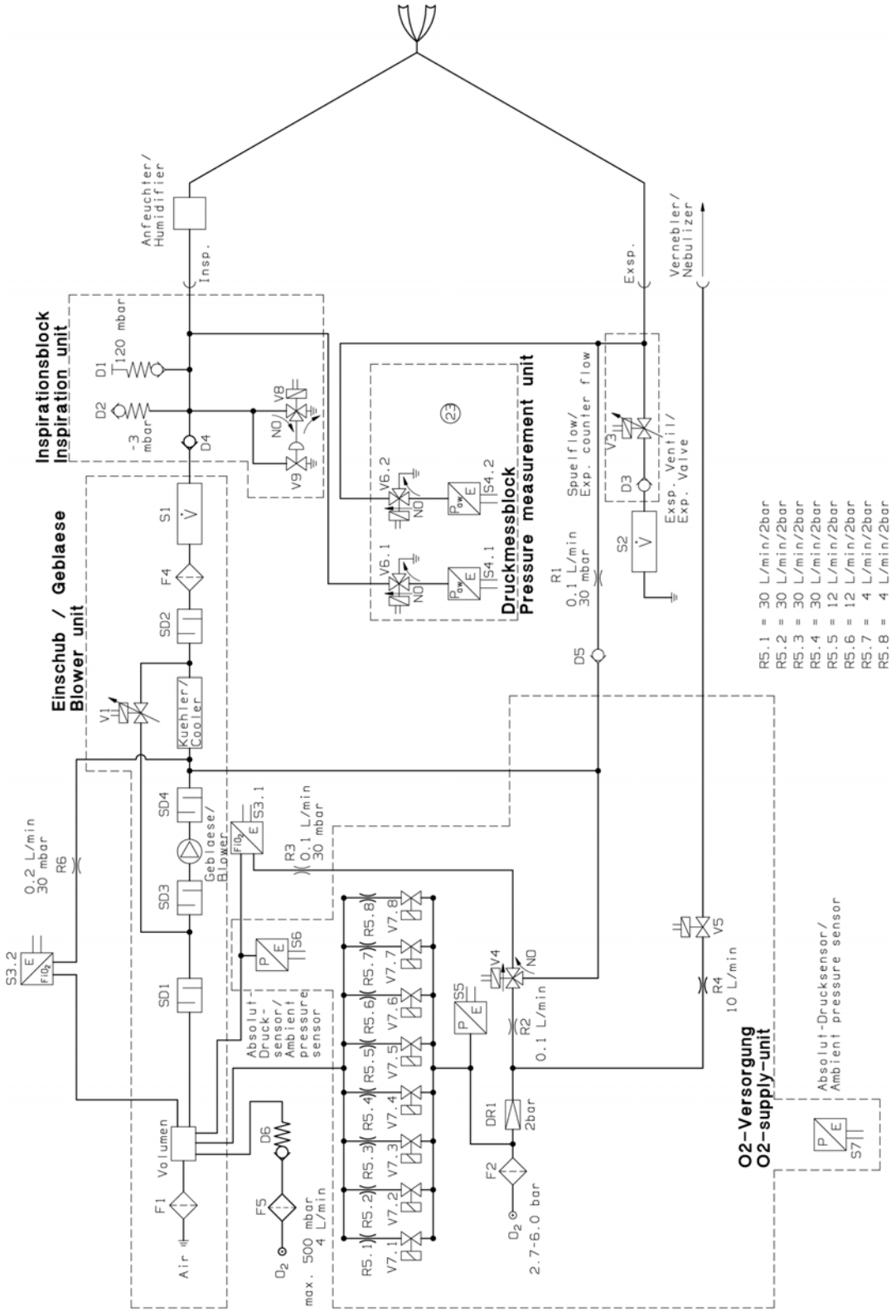


Figure 14 Pneumatic diagram 8412996, revision index 23

5 Tubing diagram

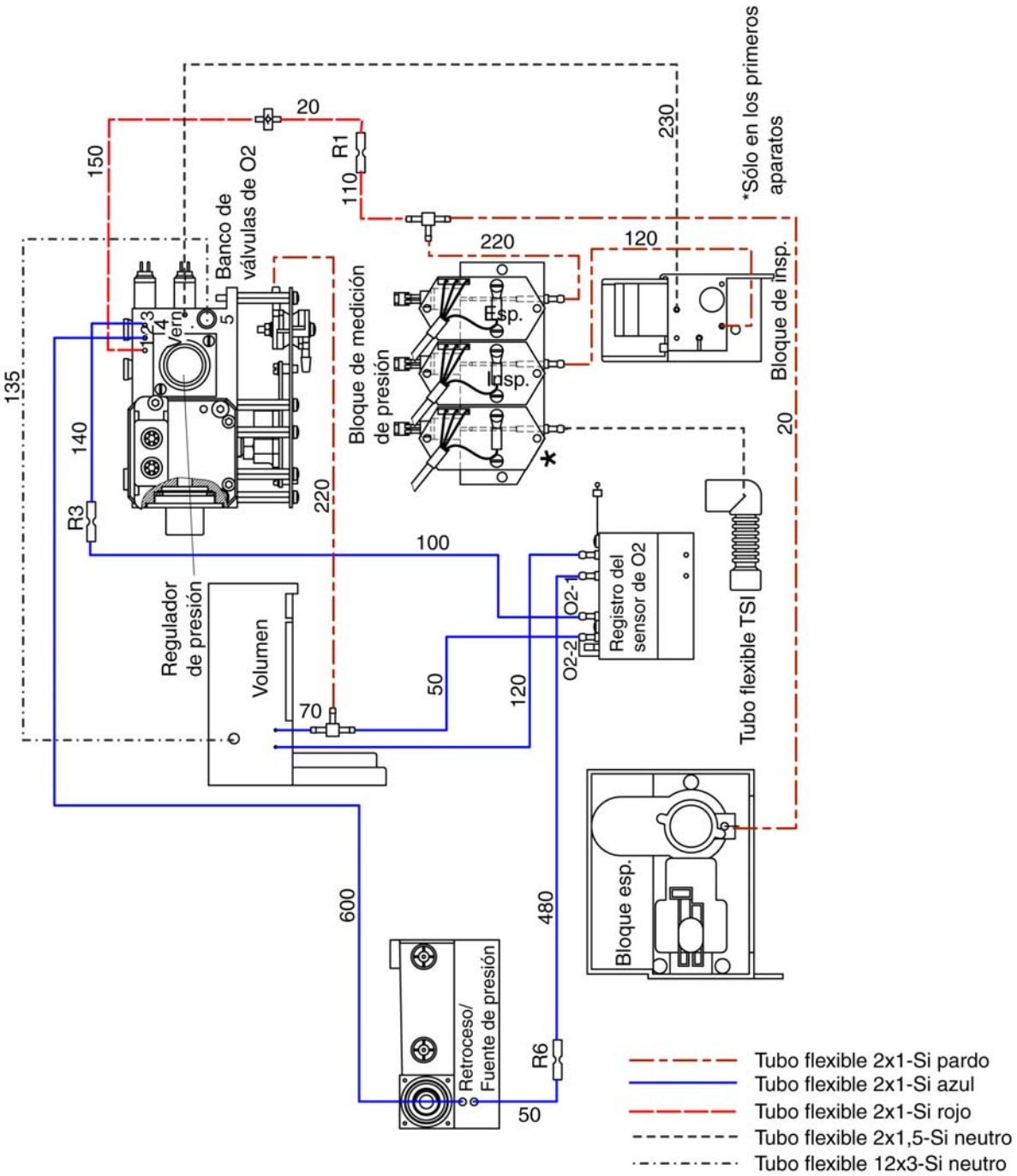


Figure 15 Tubing diagram

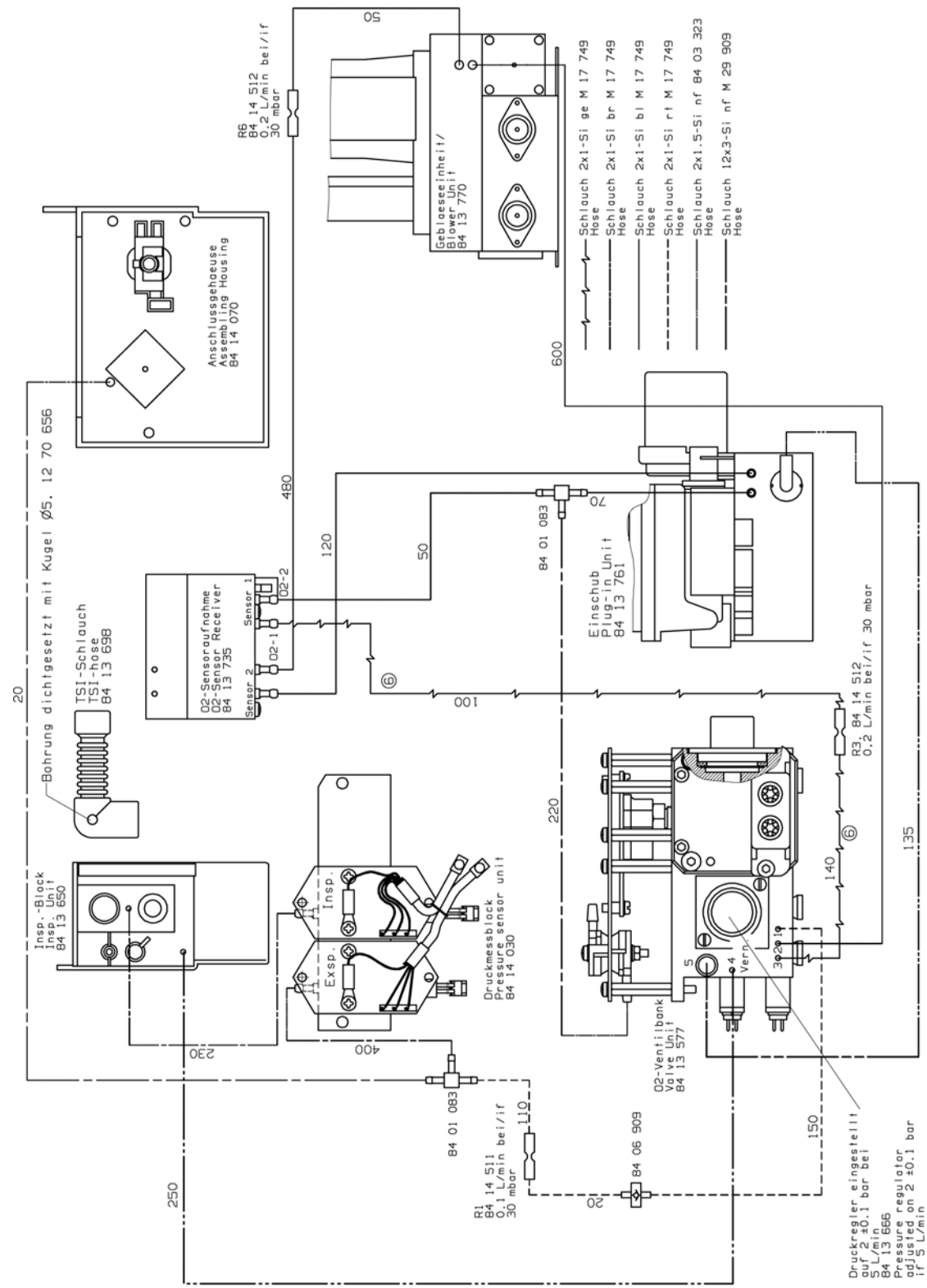


Figure 16 Tubing diagram 8413759, revision index 06

Annex

Parts catalog

Test List

Technical Information

Dräger medical
A Dräger and Siemens Company

Parts catalog

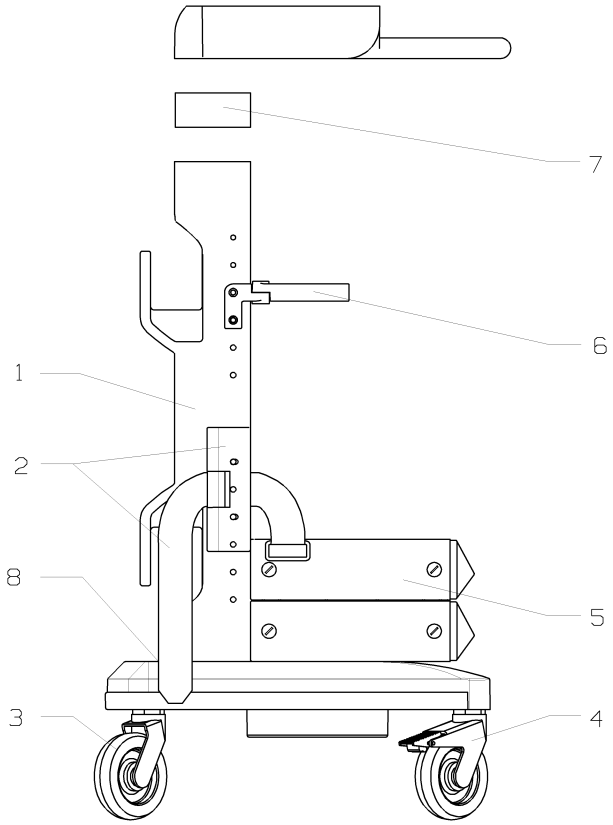
Savina

Revision: 2005-12

5664.900

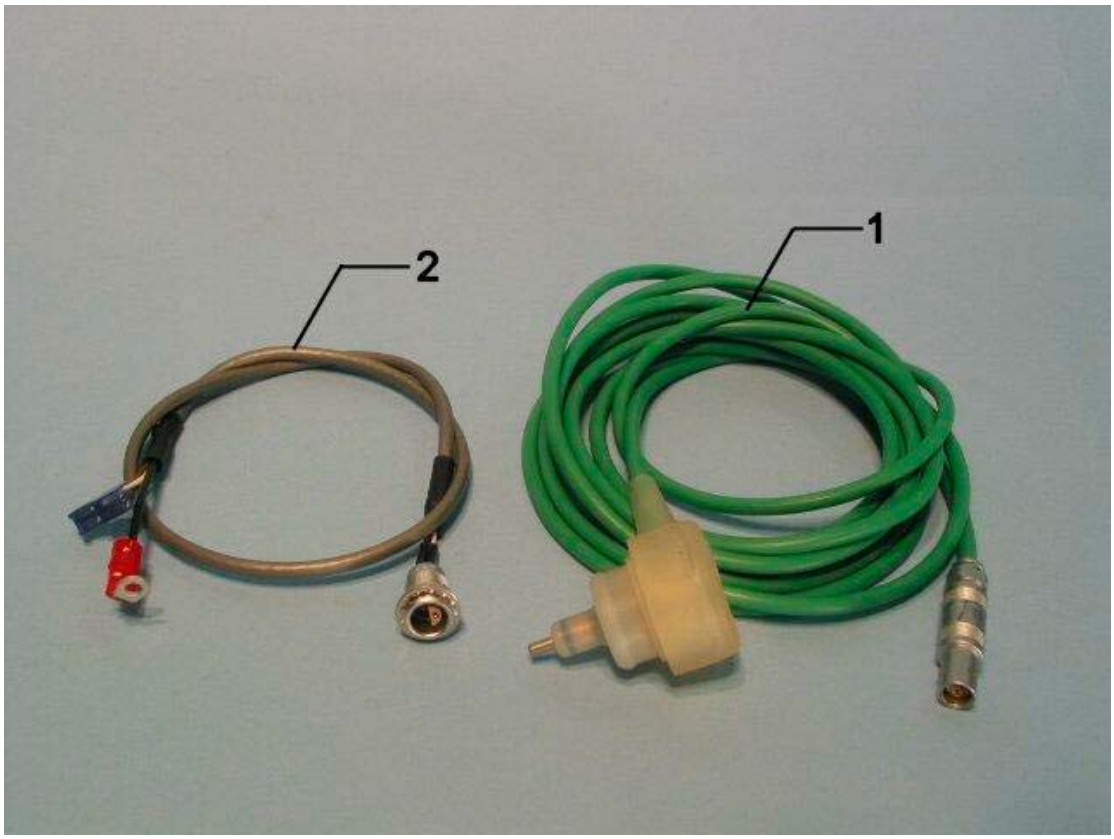
Item No.	Part No.	Description	Qty.	Qty.unit	Remark
	8414000	Savina basic unit	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



Item No.	Part No.	Description	Qty.	Qty.unit	Remark
2	8411970	SET CYLINDER BRACKET EV. MOBIL	1.000	St	2 pieces
8	8411973	Inlet	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts

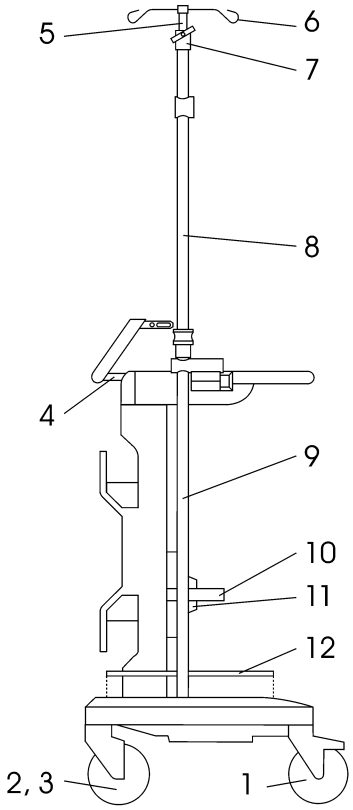


Item No.	Part No.	Description	Qty.	Qty.unit	Remark
1	8405371	TEMPERATURE SENSOR	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts

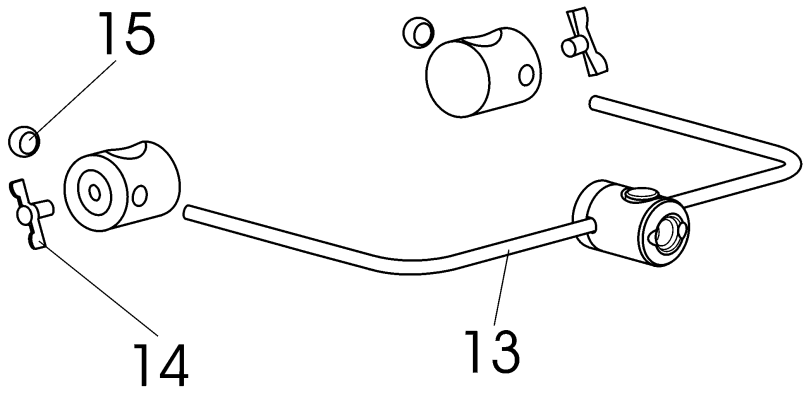
Item No.	Part No.	Description	Qty.	Qty.unit	Remark
1-8	8413660	EXPIRATION VALVE	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



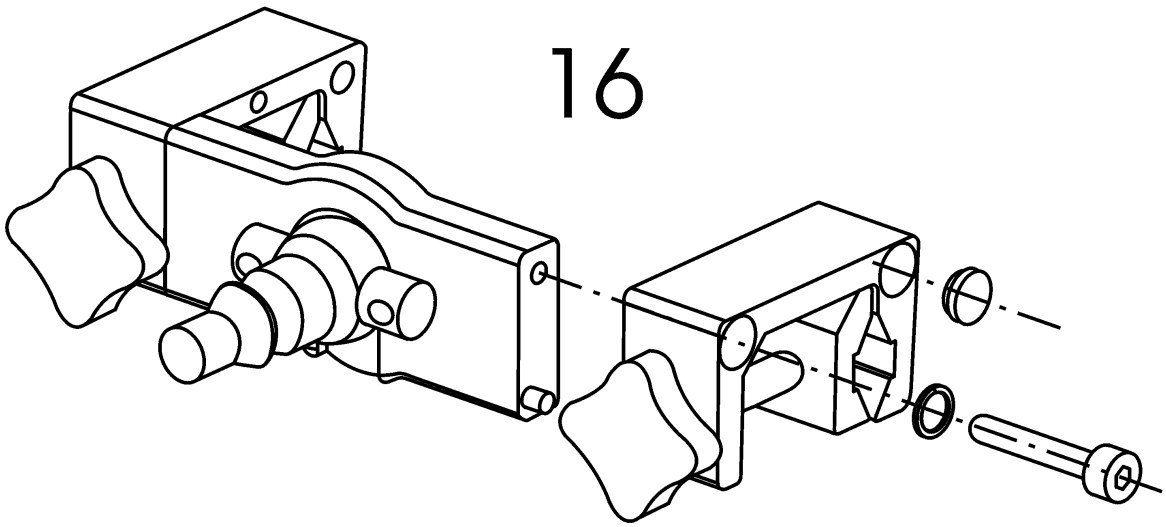
Item No.	Part No.	Description	Qty.	Qty.unit	Remark
1	8415810	Lockable castor	1.000	St	
2	8414227	CASTOR	1.000	St	
3	8414228	ROLLER, UNLOCKED	1.000	St	
4	8415821	Handle interface kit	1.000	St	
5	8415817	Telescopic rod	1.000	St	
6	MP00050	Infusion bottle cross, 4-arm	1.000	St	
7	8415815	Clamp bush with T-handle	1.000	St	
8	8414688	TRANSPORT-INFUSION-ROD	1.000	St	
9	8415823	Later pole kit	1.000	St	
10	8411972	belt	1.000	St	
11	8415820	Cylinder holder kit	1.000	St	
12	8411973	Inlet	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



Item No.	Part No.	Description	Qty.	Qty.unit	Remark
13	8415545	Coupling, device-side	1.000	St	
14	8414217	TOMMY SCREW	1.000	St	
15	1255673	Spherical end-piece	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts



Item No.	Part No.	Description	Qty.	Qty.unit	Remark
16	8415544	Coupling, bedside	1.000	St	

Items that are shown in the illustration but are not listed below the illustration are not available as spare parts

Assembly	Description	Part No.
Accessories for operation		
	O2-HOSE NIST 3M DIN PROBE	M34402
	O2-HOSE NIST 5M DIN PROBE	M34403
Adult-Ventilation		
	ADULT HOSE SET, F+P	8412108
	Anfeuchter-Grundeinh. MR850AGU	8414720
	AQUAPOR (220-240V)	8405020
	Aquapor EL, Humidifier	8414698
	F&P MR 730 AGU Befeuchter	8418285
	HOSE SET E2 (BLUE)	8413146
	HOSE SET HME	8412860
	HUMIDIFIER CHAMBER MR 370 (A)	8412217
	MOUNTING KIT F&P	8411074
	PATIENT PART (AQUAPOR)	8405029
	SET OF SPARE BRACKETS	8403345
	TEMPERATURE SENSOR	8405371
cable		
	CABLE RS232 MEDIBUS	8306488
	DC-battery cable S	8414092
	DC-Board mains cable S	8414048
	Interface Cable RS232	8413627
exp.Flow-Measurement Spirolog		
	Set of 5 Spirolog sensors	8403735
Expendable Items		
	ABSORBENT PAPER REFILL PACK	8411073
	COMFORT-FIT MASK 4	MX22904
	COMFORT-FIT MASK 6	MX22906
	COMFORT-FIT MASK ROUND	MX22907
	MICROFILTER	6737545
	OXYTRACE VE	MX01049
	SecuRed Big, ST	MX02650
	SecuRed L, ST	MX02652
	SET DUST FILTER S	8414057
	SET HME EASYTUBE	MX22750
	Set of 5 Spirolog sensors	8403735
Expiration Valve		
	EXPIRATION VALVE	8413660
	FLOWSENSOR BUSHING,CPL.	8414080
	Membrane, complete	8413661
	POT	8403976

Assembly	Description	Part No.
ext. Battery/accessories		
	BATTERY 12V/17AH	1843303
	DC-battery cable S	8414092
	DC-Board mains cable S	8414048
Infant Vent. w. MR 730/850		
	DRAW WIRE 1,50 M 900 MR 070	8411050
	DUAL AIRWAY TEMP. SENSOR 1,45M	8411048
	F&P MR 340 Kammer (d)	8418286
	Hose kit adult	8414986
	PAED HOSE SET, F+P	8412081
	SecuRed L, ST	MX02652

Assembly	Description	Part No.
Instructions for use Savina		
	GA Savina Sw 2.n ru	9037392
	IDU Savina SW 3.n fi	9037964
	IFU Savina 2.1 fr	9037627
	IFU Savina english	9037388
	IFU SAVINA ES	9029173
	IFU Savina french	9037389
	IFU Savina french	9037283
	IFU Savina german	9037366
	IFU Savina italian	9037391
	IFU Savina italian	9037285
	IFU Savina nl	9037297
	IFU Savina spanish	9037390
	IFU Savina spanish	9037284
	IFU SAVINA SW 1.N DE	9029170
	IFU SAVINA SW 1.N EN	9029171
	IFU Savina SW 2.1n de	9037624
	IFU Savina SW 2.1n en	9037625
	IFU Savina SW 2.1n es	9037628
	IFU Savina SW 2.1n it	9037629
	IFU Savina SW 2.1n nl	9037630
	IFU Savina SW 2.1n ru	9037631
	IFU Savina SW 2.1n sk	9037642
	IFU Savina SW 3.n bg	9037970
	IFU Savina SW 3.n cs	9037969
	IFU Savina SW 3.n de	9037953
	IFU Savina SW 3.n en	9037957
	IFU Savina SW 3.n es	9037960
	IFU Savina SW 3.n fr	9037959
	IFU Savina SW 3.n hu	9037968
	IFU Savina SW 3.n it	9037961
	IFU Savina SW 3.n nl	9037962
	IFU Savina SW 3.n pl	9037966
	IFU Savina SW 3.n pt-br	9037965
	IFU Savina SW 3.n ru	9037963
	IFU Savina SW 3.n sk	9037972
	IFU Savina SW 3.n zh	9037967
	IFU Savina TransportMobil de/en	9037438
	UM Savina 2.1n enUS	9037626
	UM Savina enUS	9037222
	UM Savina enUS	9037409
	UM Savina SW 2.1n fi	9037632
	UM Savina SW 2.1n pl	9037634
	UM Savina SW 2.1n pt	9037633
	UM Savina SW 2.1n zh	9037635

Assembly	Description	Part No.
	UM Savina SW 2.n nl	9037427
	UM Savina SW 3.n enUS	9037958
int. Battery/accessories		
	ACCU 12V 3,5AH	1841416
	DC-Connecting AKKU, AKKU	8413604
Maintenance parts/service Kits		
	BATTERY 12V/17AH	1843303
	Membrane, complete	8413661
	MICROFILTER	6737545
	SET DUST FILTER S	8414057
Modification Kits/Options		
	Nurse call connector	1846248
O2-CS-Connectors		
	O2-ANSCHLUSS (DISS)	8412961
	O2-HOSE NIST 3M DIN PROBE	M34402
	O2-HOSE NIST 5M DIN PROBE	M34403
	Plug O2 M12X1, right	4300988
O2-Measurement		
	OXYTRACE VE	MX01049
optional accessory		
	BATTERY 12V/17AH	1843303
	CABLE RS232 MEDIBUS	8306488
	Child-Resutator 2000	2120984
	DC-battery cable S	8414092
	DC-Board mains cable S	8414048
	HINGED ARM 240-DEGR.	8409609
	HOOK	M26349
	MED. NEBULIZER EVITA 4 (PNEU)	8412935
	Quickstop hinged arm 2	2M85706
	Resutator 2000 adults	2120046
	Side-Rails	8414358
	TEST LUNG	8403201
Power Supply		
	BATTERY 12V/17AH	1843303
	DC-battery cable S	8414092
	FUSE 15A	1850369
	FUSE,5A	1850377

Assembly	Description	Part No.
Powercords		
	Power cable 10A, 3m, grey, USA/J	1841793
	Power cable Australia 3m,10A,C13L	1844350
	Power cable DK, 3 m, 10 A	1844342
	Power cable Great Britian 3m black	1844369
	POWERCORD CH 3M	1844377
	SUPPLY MAIN, 3M	1824481
Powerpack all SW-versions		
	FUSE 15A	1850369
	FUSE,5A	1850377
Products concerned		
	Savina basic unit	8414000
Savina TransportMobil		
	belt	8411972
	CASTOR	8414227
	Clamp bush with T-handle	8415815
	Coupling, bedside	8415544
	Coupling, device-side	8415545
	Cylinder holder kit	8415820
	Handle interface kit	8415821
	Infusion bottle cross, 4-arm	MP00050
	Inlet	8411973
	Later pole kit	8415823
	Lockable castor	8415810
	Rail spacer bushes kit	8415822
	ROLLER, UNLOCKED	8414228
	Spherical end-piece	1255673
	Telescopic rod	8415817
	TOMMY SCREW	8414217
	TRANSPORT-INFUSION-ROD	8414688
Temperature sensor AWT		
	TEMPERATURE SENSOR	8405371
Trolley		
	Inlet	8411973
	SET CYLINDER BRACKET EV. MOBIL	8411970

Test List
Savina

Serial no. _____

Installation site _____

File no.:
5664.900

Edition:
08.2005

1 General

The procedures described in this Test List can be carried out using commercially available test equipment and tools. However, this Test List does not replace inspections and servicing by the manufacturer.

2 Test equipment required for the Test List

Pressure gauge -10 mbar to 10 mbar	Class 1.6
Pressure gauge 0 mbar to 120 mbar	Class 1.6
Flowmeter 10 L/min to 120 L/min	Class 1.6
Flowmeter 0.01 L/min to 14 L/min	Class 1.6
Syringe, 50 mL	
T-piece or Y-piece	
Thermometer	
Test pressure regulator	
Injector	

3 General condition

- Markings on Savina are complete and legible. ☐
- Savina is undamaged. ☐
- Dust filter must not be dirty or pressed together. ☐
- Micro-filter has been replaced at regular intervals. ☐
- Inspiration block is undamaged. ☐
- Check locking function of the expiratory valve mount. ☐
- Visually inspect the expiratory valve. ☐

3.1 Accessories (if fitted)

- Check the following components for damage and, if applicable, for country-specific color coding.

– Trolley ☐
– Multiple socket outlet ☐
– Hinged arm ☐
– O2 connecting hose ☐
– Temperature sensor ☐
– Respiratory gas humidifier ☐
– Hose systems as specified in the Instructions for Use ☐

4 Special accessories (option)

- Check the following parts for possible damage and correct functioning:

– Pneumatic drug nebulizer ☐
– Adult test lung ☐
– Resutator 2000 ☐
– Child Resutator 2000 ☐
– Medibus cable ☐
– DC battery cable/DC on-board supply cable ☐
– O2 elbow connector 90 degrees ☐
– Side rails kit ☐
– LPO-Connector ☐

5 Accompanying documents check

– Instructions for Use manual is available ☐
– Medical product logbook is available (applies to Germany only) ☐

6 Safety checks

• Check the power cable for possible damage. ☐
• The fuse links are as specified on the rear panel. ☐

6.1 Test of electrical safety to VDE 0751

6.1.1 Protective earth conductor resistance

• Measure the protective earth conductor resistance according to VDE 0751.

The protective conductor resistance should be less than/equal to 0.3 ohms. ☐

6.1.2 Equivalent unit leakage current

• Measure the equivalent device leakage current according to VDE 0751.

The equivalent leakage current is less than/equal to 1000 μA ☐

6.1.3 Equivalent patient leakage current

• Measure the equivalent patient leakage current according to VDE 0751.

The equivalent patient leakage current is less than/equal to 5000 μA ☐

6.2 Test of electrical safety to IEC 60601-1

6.2.1 Protective earth conductor resistance

- Measure the protective earth conductor resistance according to IEC 60601-1.

The protective earth conductor resistance should be less than/equal to 0.2 ohms.. ☐

6.2.2 Earth leakage current

- Measure the earth leakage current according to IEC 60601-1.

Normal condition (N.C.): I less than or equal to 500 μA. ☐

Single fault condition (S.F.C.): Neutral conductor interrupted: I less than or equal to 1000 μA. ☐

6.2.3 Patient leakage current

- Measure the patient leakage current according to IEC 60601-1.

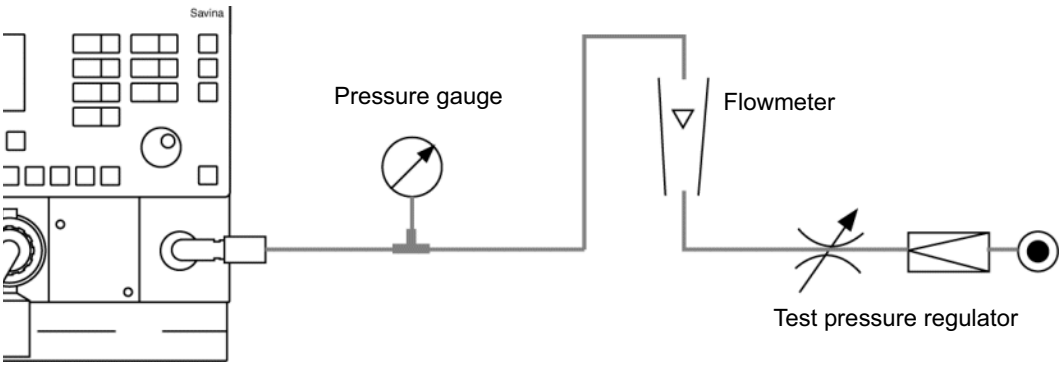
Normal condition (N.C.): I less than or equal to 100 μA. ☐

Single fault condition (S.F.C.): Neutral conductor interrupted: I less than or equal to 500 μA. ☐

7 Testing the safety features

7.1 Testing the pneumatic safety valve

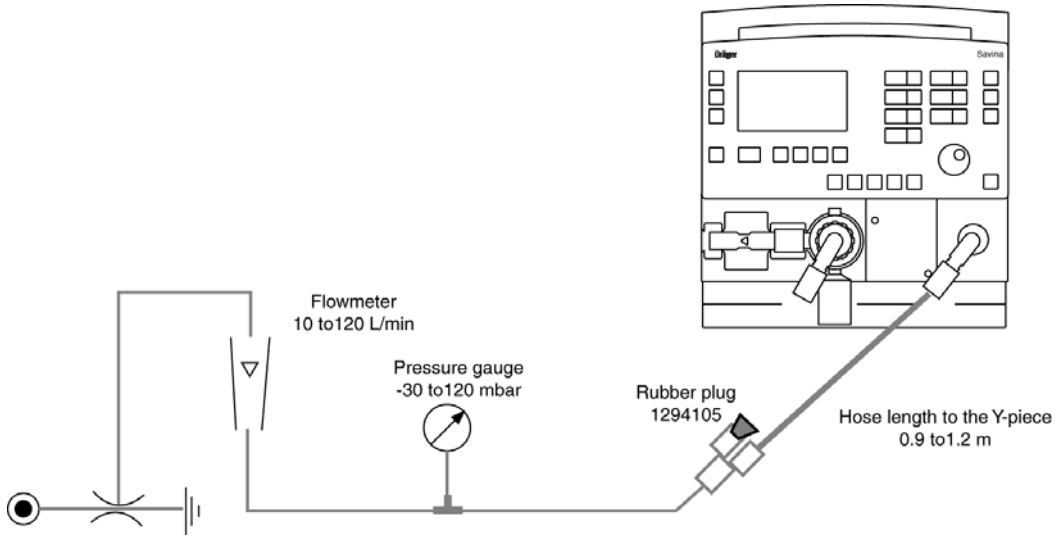
- Switch off the device.
- Using the test pressure reducer, set a flow of 2 L/min +1 L/min.



The pressure at the inspiratory port must be between 80 mbar and 120 mbar. ☐

7.2 Testing the emergency air valve

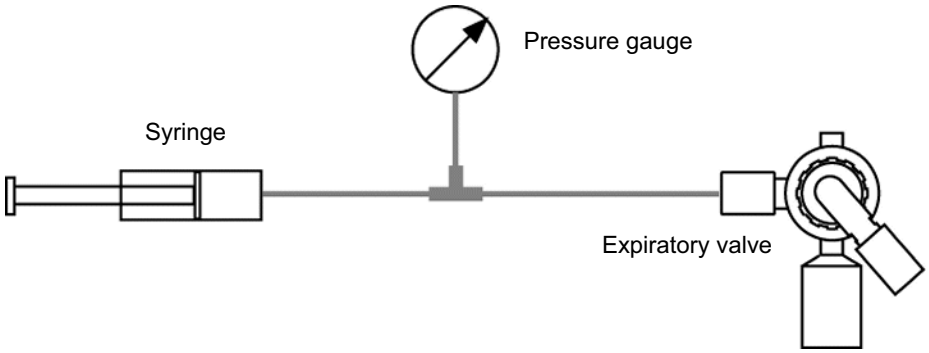
- Switch off the device.
- Using the test pressure regulator and the injector set a flow of 60 L/min ±1 L/min.



The emergency air valve opens. The pressure at the Y-piece is -3 mbar to -6 mbar. ☐

7.3 Testing the non-return valve in the expiratory valve

- Using the syringe, slowly (permissible pressure change less than 1 mbar/s) build up a pressure of 2.5 mbar ±0.5 mbar at the outlet of the expiratory valve.



The volume injected through the syringe in one minute must not exceed 35 mL. ☐

7.4 Testing the emergency expiratory valve

- Operate the unit with the test lung fitted and with the following settings:
  - IPPV mode
  - Frequency: f = 6 1/min
  - Tidal volume: Vt = 0.5 L/min
  - End-expiratory pressure: PEEP = 5 mbar
  - Oxygen concentration: O_2 = 21 vol.%
  - Inspiratory time: Tinsp = 5 s
  - Airway pressure limit: Paw high = 10 mbar above peak pressure
- Seal the expiratory hose.

The unit builds up a pressure up to the Paw high limit, then the pressure is reduced momentarily to less than 6 mbar through the emergency expiratory valve. ☐

7.5 Testing the temperature measurement

- Connect the temperature sensor.

The current ambient temperature is displayed. ☐

8 Checking the readiness for operation according to Instructions for Use/Operating Instructions

- Check the readiness for operation of the unit according to the Instructions for Use/Operating Instructions. ☐

9 Handover

- Supply unit to customer ready for operation. ☐

Date: _ _ _ _ _ _ _ _ _ _ _ _ _ _ Name: _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Dräger medical
A Dräger and Siemens Company

2005-12-15

Technical Documentation for Savina according to EMC standard IEC/EN 60601-1-2: 2001

General Information

The EMC conformity includes the use of following external cables, transducers and accessories (see the following table):

Designation	Order no.
Temperature sensor el.	84 05 371
MEDIBUS cable	83 06 488
DC battery cable S (ext. battery)	84 14 092
Ext. lead-gel batteries 12 V/17 Ah	18 43 303
DC cable S, for external DC supply on board	84 14 048
Nurse call system (option)	84 13 631
Plug for the connection of nurse call system	18 46 248

Savina should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is inevitable, Savina should be observed to verify normal use in the configuration in which it will be used.

Other equipment which can be used adjacent to or stacked with the Savina are listed in the Instructions for Use manual, in the Order List chapter or in the following table.

Designation	Order no.
Aquapor EL respiratory gas humidifier	84 14 698
Fisher & Paykel humidifier - accessories	84 14 144
Optional graphic screen	84 15 834
Permox SilentCare	57 30 289
ECG monitoring	Various, on demand

Electromagnetic Emissions

Electromagnetic Emissions		
Savina is intended for use in the electromagnetic environment specified below. The operator should assure that is used in such an environment.		
Emissions	**Compliance according to**	**Electromagnetic environment**
RF emissions (CISPR 11)	Group 1	Savina uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
	Class A	Savina is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions (IEC 61000-3-2)	Not applicable	Not applicable because RF emissions are class A.
Voltage fluctuations / flicker (IEC 61000-3-3)	Not applicable	Not applicable because RF emissions are class A.

Information re electromagnetic emissions (IEC 60101-1-2: 2001, table 201)

Electromagnetic Immunity

Electromagnetic Immunity			
Savina is intended for use in the electromagnetic environment specified below. The operator should assure that is used in such an environment.			
Immunity against	**IEC 60601-1-2 test level**	**Compliance level (Savina)**	**Electromagnetic environment**
electrostatic discharge, ESD (IEC 61000-4-2)	contact discharge: ± 6 kV air discharge: ± 8 kV	± 2, 4, 6 kV ± 2, 4, 8 kV	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
electrical fast transients / bursts (IEC 61000-4-4)	power supply lines: ± 2 kV longer input / output lines: ± 1 kV	± 2 kV ± 1 kV	Mains power quality should be that of a typical commercial or hospital environment.
surges on AC mains lines (IEC 61000-4-5)	common mode: ± 2 kV differential mode: ± 1 kV	± 2 kV ± 1 kV	Mains power quality should be that of a typical commercial or hospital environment.
power frequency magnetic field 50/60 Hz (IEC 61000-4-8)	3 A/m	3 A/m	In close vicinity to Savina, no equipment with extraordinary power frequency magnetic fields (power transformers, etc.) should be operated.
voltage dips and short interruptions on AC mains input lines (IEC 61000-4-11)	dip >95%, 0.5 periods dip 60%, 5 periods dip 30%, 25 periods dip >95%, 5 seconds	>95%, 0.5 per. 60%, 5 per. 30%, 25 per. >95%, 5 sec.	Mains power should be that of a typical commercial or hospital environment. If operator requires continued operation during power mains interruptions, it is recommended to power Savina from an uninterruptible supply or a battery.
radiated RF (IEC 61000-4-3)	80 MHz – 2.5 GHz: 20 V/m	20 V/m	Recommended separation distance from portable and mobile RF transmitters with transmission power P_{EIRP} to Savina including its lines: 1.84 m * $\sqrt{P_{EIRP}}$ [X1]
RF coupled into lines (IEC 61000-4-6)	150 kHz – 80 MHz: 10 V within ISM bands, 3 V outside ISM bands [X2]	10 V 3 V	Recommended separation distance from portable and mobile RF transmitters with transmission power P_{EIRP} to Savina including its lines: 1.84 m * $\sqrt{P_{EIRP}}$ [X1]

Information re electromagnetic immunity (IEC 60601-1-2: 2001, tables 202, 203, 204)

[X1]: For P_{EIRP} the highest possible "equivalent isotropic radiated power" of the adjacent RF transmitter has to be inserted (value in Watt). Also in the vicinity of equipment marked with the symbol  interference may occur. Field strengths from fixed, portable or mobile RF transmitters at the location of Savina should be less than 3 V/m in the frequency range from 150 kHz to 2.5 GHz and less than 1 V/m above 2.5 GHz.

[X2]:ISM bands in this frequency range are: 6.765 MHz - 6.795 MHz, 13.553 MHz - 13.567 MHz, 26.957 MHz - 27.283 MHz, 40.66 MHz - 40.70 MHz.

Recommended separation distances

Recommended separation distances between portable and mobile RF telecommunication devices and the Savina			
max. P_{EIRP} (W)	**3 V/m distance* (m)**	**1 V/m distance* (m)**	**Note**
0.001	0.06	0.17	
0.003	0.10	0.30	
0.010	0.18	0.55	
0.030	0.32	0.95	e.g. WLAN 5250 / 5775 (Europe)
0.100	0.58	1.73	e.g. WLAN 2440 (Europe), Bluetooth
0.200	0.82	2.46	e.g. WLAN 5250 (not in Europe)
0.250	0.91	2.75	e.g. DECT devices
1.000	1.83	5.48	e.g. GSM 1800- / GSM 1900- / UMTS- mobiles, WLAN 5600 (not in Europe)
2.000	2.60	7.78	e.g. GSM 900 mobiles
3.000	3.16	9.49	

Information re separation distances (IEC 60601-1-2: 2001, tables 205 and 206)

* 3 V/m distance to transmitters with frequencies from 150 kHz to 2.5 GHz, otherwise 1 V/m distance.

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CE 0123

Directive 93/42/EEC
concerning Medical Devices

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